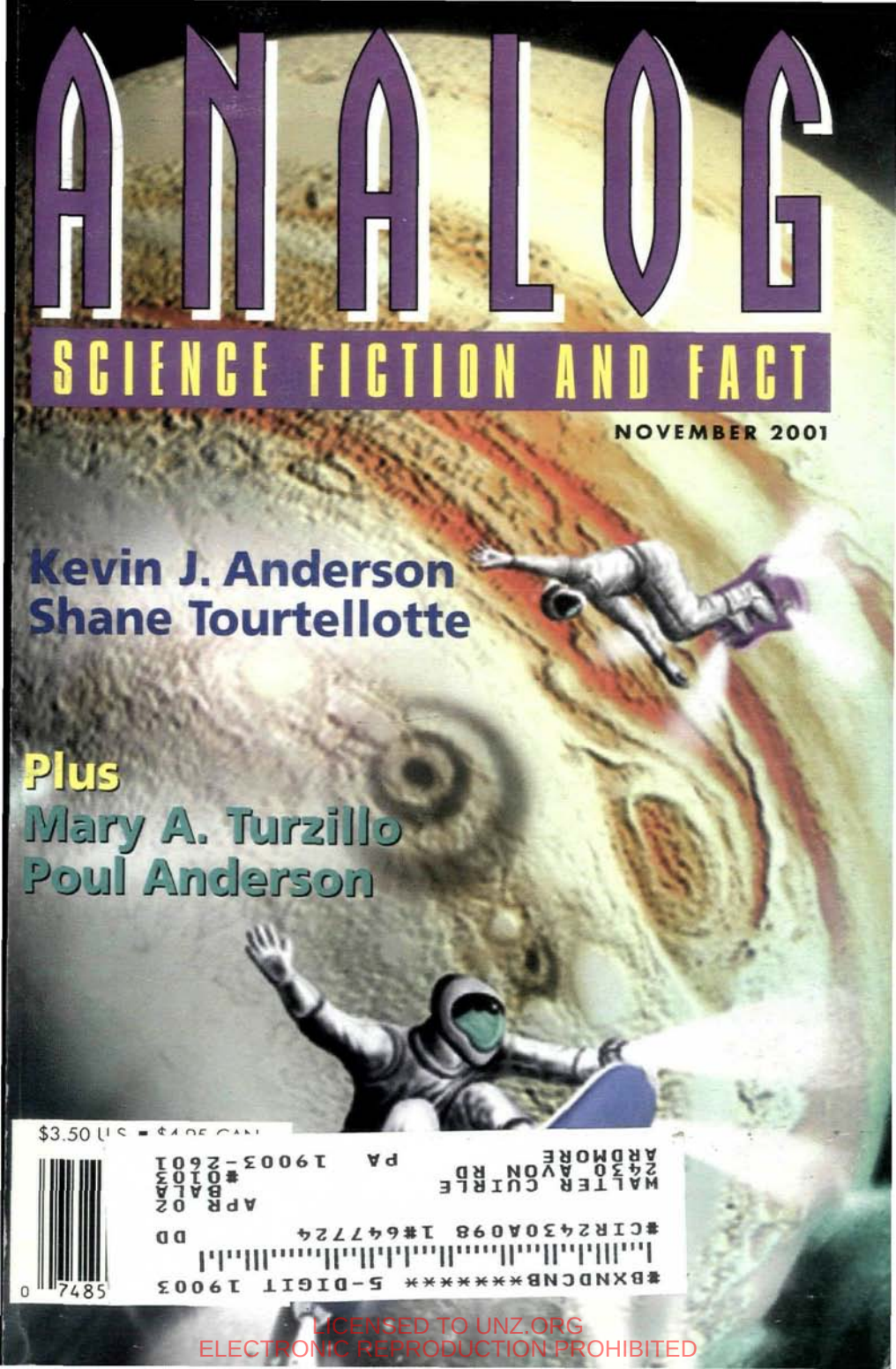
ANALOG

SCIENCE FICTION AND FACT

NOVEMBER 2001



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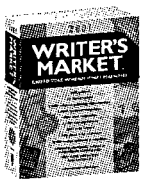

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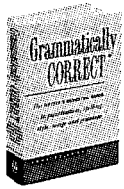

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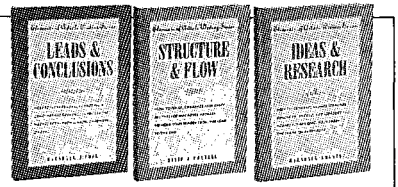

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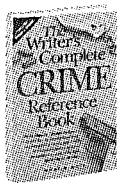

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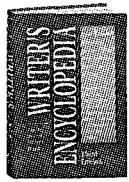

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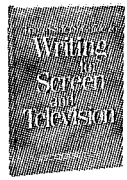

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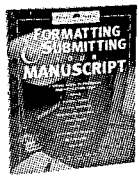

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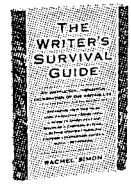

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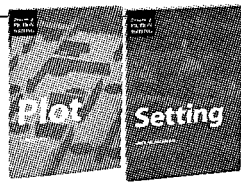

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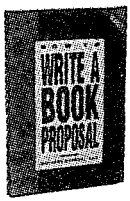

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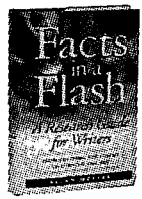

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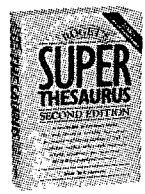

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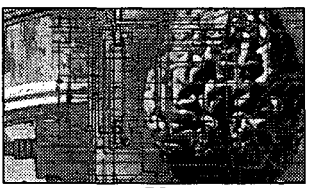

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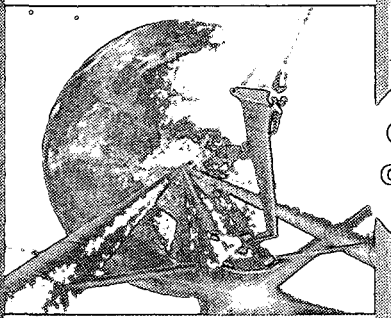

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EDITORIAL Stanley Schmidt

BARREN LANDS, BARREN MINDS

A familiar old maxim tells us that "Beauty is in the eye of the beholder." This could be construed as meaning that beauty is simply a matter of personal taste, but I think there's a bit more to it than that. It can also mean that a trained eye can see beauty where an untrained would not, simply by virtue of being able to notice and appreciate qualities and relationships that might not be obvious to a casual observer.

People sometimes laugh when first exposed to the concept of "learning to see"—after all, they may say, *everybody* can see—but the fact is that specific kinds of observation can and must be learned. A beginning student pilot often can see no sign of a landmark that his instructor casually uses for navigation. A beginning ornithologist may not even see a bird which her more experienced friend is meanwhile identifying by the color of a tiny patch of skin between eye and beak. A friend I was camping with was quite surprised by my reference to the "quality of light" we were experiencing, saying he had never thought of describing things in such terms—but he became fascinated by the concept, started watching for it and learning about it, and he's now a serious and accomplished photographer.

Beauty does not have to be visual, of course, and the idea of "learning to see" can easily be extended to any other kind of sensing—or thinking. You don't have to have any formal knowledge of musical forms or rules of harmony to enjoy a piece of music, but you'll probably get even more out of it if you do than if you don't.

I was reminded of this a few months back when I read that a senator, frustrated with some of his colleagues' reluctance to open the Arctic National Wildlife Refuge to oil drilling, planned to lead a group of them on an expedition to see the Refuge for themselves. He was quoted as saying something very much like, "Once they see what a barren land it is, maybe they'll care less about protecting it." And I caught myself thinking, "If beauty is in the eye of the beholder, is barrenness in the mind of the beholder?"

Irreverent though the thought may be, I fear it has more than a little truth in it. I'm frankly a little wary of people who use the phrase "barren lands"; it seems to me that it often says less about the barrenness of the land than about the barrenness of the mind that can't see what's there unless it's easily measured in dollars. I can't say I've never used the phrase myself, but I've never used it very much, and experience has led me to use it even less as I've gotten older. I can remember thinking of the treeless grasslands of North America's Great Plains as empty and monotonous—until I hiked a few miles across them, paying attention to what was around me and at my feet, and did some research on how they worked.

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Even earlier, I had similar misconceptions about deserts, until I read Joseph Wood Krutch's *The Voice of the Desert*, and later got some firsthand desert experience of my own.

In both cases I saw only barrenness until I learned to see what was really there, and to understand it in terms of a larger context. But learn I did, so I know it can happen. Therefore I hope that senate expedition *will* go to the Arctic, and that *all* of them—including their pedagogically inclined leader—will learn something. This means, of course, that they will have to do a good deal more than ride across the tundra in a bus, looking out the window and shaking their heads at the barrenness of What's Out There. That, I gather, is what their leader hopes they will do, and as a result become convinced that the land would be put to much better use if the barrenness were relieved with oil rigs and trucks and pipelines to produce something Useful that can be marketed to power other Useful Things like sport utility vehicles and state limousines. But that is not enough. If they are really to learn enough to formulate the best policy for managing the Arctic NWR, they must *really* get to know it—which will require, among other things, some advance reading about arctic ecosystems and how they work, and getting out to *walk* some of that country under the guidance of someone intimately familiar with it. And it may require some education in general ecology, to provide that larger context. Only thus might they gain some understanding of why preserving one of the last large samples of a unique ecology just might have some value that is not simply measured in dollars and cents, but is nonetheless exceedingly large.

They need that anyway, because early indications are that the current administration is barreling (no pun intended) down a metaphorical road to a heavy-handed assault on the wrong aspects of a whole complex of interrelated problems. We are experiencing an energy crisis, they tell us; therefore we must quickly find, remove, and use as much additional oil as possible, with little regard for what the costs might be in any measure except dollars—or what else might be done to reduce that perceived need. Does it really make sense to say we desperately need more oil when millions of people with no real need for them are driving gas-guzzling (and correspondingly polluting) SUVs? Wouldn't it make more sense to try to reduce that and other forms of excessive and unnecessary consumption before rushing headlong into drastic means of increasing supply? Few would argue that the best way to solve a problem with widespread drug addiction is to increase the supply of drugs by whatever means it takes. That's the addict's idea of a solution; it should not be the government's.

Far be it from me to disparage SUVs; they're wonderful things, in appropri-

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ate times and places. I've used them where they made sense, and in fact were necessary—on the roadless savannas of East Africa. I had to admire the ruggedness of a Toyota Land Cruiser when I was riding one that dropped a wheel in an aardvark hole and drove on, undamaged, a few minutes later. But the vast majority of American streets bear little resemblance to the African savanna, and the vast majority of SUVs in this country never see conditions where their special qualities are needed. They serve no purpose beyond making their owners feel macho, fashionable, and in control of a lot of power. Meanwhile, their construction consumes great quantities of unnecessary material and their use consumes great quantities of unnecessary fuel, in the process adding lots of unnecessary pollution to the atmosphere—including kinds that contribute to global warming.

Global warming is another part of that overall problem-complex, and it makes little sense to plunge into one part of it while ignoring the others. What you do to any subproblem will affect what happens with the others. And the overarching problem of which all the others are mere aspects, and the one that hardly anyone wants to confront head-on, is population: most of our other problems result directly or indirectly from excessive and/or excessively fast population growth.

And no, it is not, as we are sometimes told, just a matter of distribution. "There's plenty of food," some say (to give just one example). "Our problem is just how to get it where it's needed." There may be some truth in that, at the moment, in the sense that the planet currently contains enough food to feed all the people it contains. But the facts remain that some particular resources are being exhausted on a global scale faster than they can be replenished even with present population levels—fisheries and petroleum reserves, to name just two. Even if people start making use of large resources that have hitherto been largely ignored, like edible insects, continued unchecked growth of either population or per capita consumption (and present trends suggest we can expect both) will inevitably lead to a world of more and more people living less and less well or comfortably.

I realize all that is a lot to expect a new government to grasp all at once, but as citizens we should insist that it

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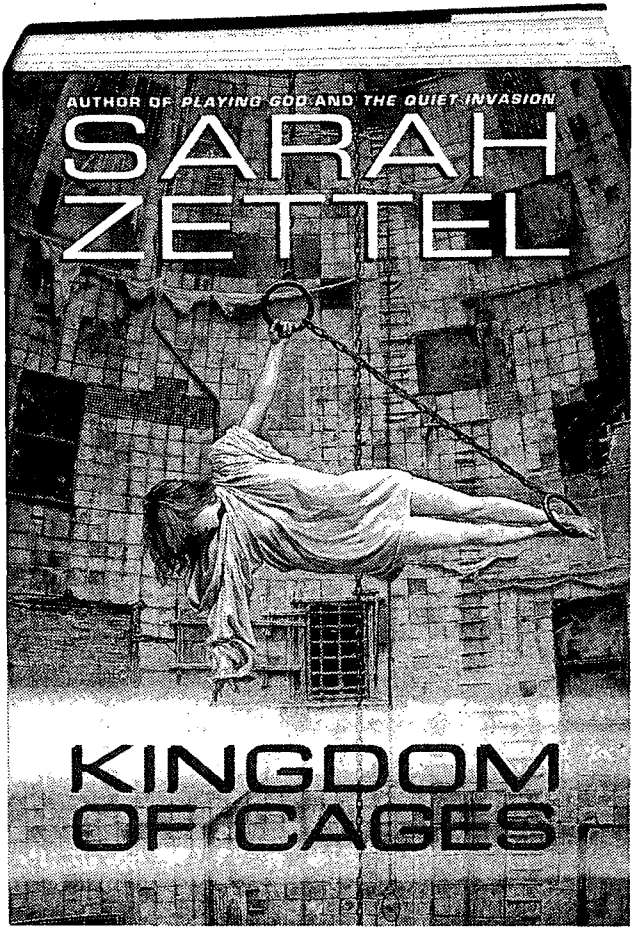

A NEW HARDCOVER

Humanity's off-world colonies are dying—all except for a lush outpost called Pandora, whose ecosystem remains intact. But soon Pandora itself will face extinction, unless drastic measures are taken. Now scientists are on the hunt for two refugee girls whose genomes hold the answer—and it doesn't matter whether they are captured dead or alive.

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try. We do not need simplistic, short-term "solutions" that will lead to long-term disasters. It's commendable that anyone in government wants to do something about an energy crisis, but it's essential that they make a serious effort to do it right. That means that deliberately hastening the depletion of a nonrenewable resource like petroleum should be way down the list of Things to Do, and that to the extent it *must* be done, it must be done with careful consideration of its impact on other assets like ecosystems—even in what some can see only as "barren lands."

In the meantime, that government should be vigorously promoting complementary and perhaps even alternative approaches like developing other energy sources, improving the efficiency of ones already in use, and discouraging the profligate squandering of resources already being exploited. To that last end, at least, I have one concrete suggestion for the new administration: set a good example.

Americans quite reasonably look with distaste upon things like outright prohibitions, rationing, and confiscatory taxes to reduce waste. But history shows that, rightly or wrongly, Americans do tend to emulate their presidents. Suppose our current administration should decide to adopt a policy of encouraging people to avoid using SUVs, for example, unless they really need them. How believable will those admonitions be if they're coming from officials most often seen in huge stretch limousines and lavishly appointed private jets?

So I respectfully suggest, with tongue only slightly in cheek, that our leaders, beginning with the president, start a vigorous campaign to make things like SUVs (and limos) unfashionable—not just by talking about it, but by visibly practicing what they preach. The president, for example, might trade in his limo for a much smaller car—armored, if necessary, but nonetheless much smaller—and perhaps a gas-electric hybrid. You can imagine the possibilities, starting from there.

They may sound far-fetched, starting from where we are, but aren't they worth a try? ■

Human alterations of the environment do not (yet) compare with such feats of nature as the moving of a continent or even the creation of the world. But we have been at it for a very short while.

— Michael Bell

The surest way to corrupt a youth is to instruct him to hold in higher esteem those who think alike than those who think differently.

— Friedrich Nietzsche

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Shipwreck

by David Livingstone Clink

A lighthouse flashes like a pulsar
cutting through the darkness—
a laser in the vacuum of space,

a warning sucked into an event horizon
where dark rocks feed black skies:
an errant ship is trapped and buffeted.

The crew in desperation are
captured in a maritime painting,
the one smaller craft sent high—

the sea lightning flashing images
of the gravity well of rock
and a ship collapsing in on itself.

Those ashore buckle down for dinner
and in the turbulent candlelight they can
almost hear the true sound of the storm—

a splintered starship coming to rest
on the ocean floor: the roar of crushed
thunder lost under living coral.

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PROLOGUE

As night fell, the city fractured into a kaleidoscope of lights, neon sparklers reflecting from rain-washed facades. Unabashedly garish, Club Masquerade hosted a dazzling assembly of humanity—new people, old people, everyone wearing a different body for the evening.

Outside the five ever-changing entrances to the Club, lighted sidewalk panels flashed patterns, numbers inside squares illuminated by each pressing footstep. Patrons walked through any of the arches into a wild environment of lights, music, exotic food, and unusual people. ID patches worked overtime to keep track of who was who, which mind in which body.

Each doorway led customers through a compact, shifting maze into any one of several tailored environment chambers: a Ming Dynasty palace, a British Empire Safari Club, a discotheque with mirror balls and strobe lights, a rustic Sequoia Room, an Arabian harem with colorful rugs and sweet perfumes, a domed Martian colony chamber with red rock and thermal springs. Finally, all the specialized alcoves opened out into the cavernous main interior of Club Masquerade. Sitting areas and dance platforms hung at various levels in the air, easily accessible by lift ramps or vacuum chutes.

You could be anyone or anything here, for a limited time—if the body you wanted was available. Pick a physique, swap with someone, wear it for a while, see if you like it.

Inside a windowless control room, invisible to the flow of customers, sat the bartender, Bernard Rovin, a lump of crippled flesh. Cybernetic substations kept his eyes and ears and automatic hands wandering throughout the bar. He observed the swirl of life, customers partaking of various entertainments, hopscotching from one body to another to another.

The jet-setters.

Separated from all that, Rovin just liked to watch, keeping track of a few special customers, regular patrons . . . "friends" of his, if the word wasn't too extreme. He knew what the date was, knew the routine. First Tuesday of the month.

Like clockwork, three customers entered separately, finding their way through the Safari Room, past the disco, and into the main bar. Two men and one woman (though occasionally they wore the opposite sex) looking around until they spotted each other at the predetermined meeting point, embraced.

Deep in his control room, the bartender smiled and directed his hands to start pouring their drinks. Like clockwork.

Garth's home-body always looked the same, except when he was on the hunt for new artistic inspiration: broad shoulders, blond hair, blue eyes, certainly nothing he'd want to change for the long term. His shirt bore paint stains, a smear of still-moving glittergel; his fingernails gritted with charcoal or chalk dust; his fingers smelled of solvents.

At first he didn't recognize Teresa, who came into the club in yet another new physique. Her hair was rusty auburn this time, her eyes green-blue, her build Rubenesque today, with broad hips. Her clothes were drab, loose fitting, as if they could have been worn by anyone . . . and they probably were. The latest religious group she had joined didn't seem to value individuality much.

Eduard, looking tired from all the hell he kept putting himself through, found both of his friends and they sat together at a private table surrounded by the white noise of conversations. At least Eduard used his hard-won money to buy stylish clothes to fit his dark-haired home-body, and he usually paid for the first couple of rounds of drinks.

He hugged Garth, pounding his friend's broad back and tousling his

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blond hair, then he took Teresa into a softer, more intimate embrace. He touched a new bruise that seeped through the makeup and freckles on her rounded cheek. "Hey, what's this, Teresa?"

"Oh, nothing," she said quickly. "And it's not mine, anyway. The last person who had this body got hurt." She turned to fold herself into Garth's muscular arms, avoiding Eduard's scrutiny.

Oblivious and happy, Garth hadn't noticed the bruise at first; now he studied her cheek intently. As an artist, he should have been the best at noticing details, but somehow Eduard always managed to have a sharper focus. Garth bent down and brushed his lips across the sore spot. "All better?"

They waved at the bartender's image on the table screen, and their usual drinks appeared before they could even speak their orders aloud.

"I hate being predictable," Eduard said, then reached over and snagged Garth's foamy dark beer instead. "It could be dangerous."

Garth looked dubiously at the slushy blue concoction Eduard usually drank; now he was stuck with it.

"Oh, try it, Garth." Teresa was amused by his discomfiture. "You're always looking for new experiences, aren't you? Drinking blue cocktail . . . *things* will add to your artistic repertoire."

On one of the dance platforms, a scarecrow-thin man stumbled backward and fell comically on his butt. The short, large-breasted woman next to him moved with awkward, marionette movements as she hurried to help him.

Eduard snorted. "There should be a law against letting people dance unless they've had at least an hour to settle into their new bodies."

Teresa touched his hand. "Oh, don't be so cynical, Eduard." On the floor of the Club, several dancers moved slowly, carefully, trying to adjust to new heights, new weights, new degrees of muscle control.

Eduard cracked his knuckles and leaned closer to the blond artist. "So what's inspiring these days, Garth?"

Garth's eyes lit up, and his gaze took on a far-off look as he talked about his passion in life. To him, the people in the Club were a catalogue of humanity. "Still seeing things, trying to understand it all, but there's so *much*. Last week I spent two days as a dwarf, and it really changes your perspective. Nothing's at the right height—not door controls, not COM terminals, not video monitors, not the transport systems. Quite a challenge just to climb up onto a barstool."

He took another sip of Eduard's blue drink, tasted crackling sweetness that burned the back of his tongue. "This is tolerable, once your taste buds get deadened."

He looked up at the Club's chaotic Hopscotch Board, aglow with "swap-portunities," people wanting to rent a muscular body to do a few days of hard labor, old men and women willing to pay for a week's vacation in a young and healthy physique, the usual sex ads searching for a two-night stand, once as a male, once as a female, or a blur of alternations before, during, and after.

"I wonder what it would feel like to be pregnant and deliver a baby," he continued. "Of course, that would require a long-term swap for at least the last month to get the full experience. And it wouldn't be easy to find a body I'd *want* to live in for that long."

Eduard rolled his eyes and looked at Teresa. "Artists! Who can understand them?" He sipped the beer he had taken from Garth, frowned, then traded drinks again.

Garth laughed. "This, from a man who gets paid to undergo surgery for other people?"

"Hey, I've got to make a living. No problem." Then he looked abashed. "Daragon saved me from a legal noose the other day, though. An old lady didn't want to give me my home-body

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back. I guess she didn't expect me to survive the operation. But Daragon showed up with just the right amount of Bureau muscle."

Teresa brightened at hearing the young man's name. Daragon had grown up with them, but he'd never managed to become more than a close outsider. He had joined the powerful Bureau of Tracing and Locations, the BTL.

"I think he spies on us," Eduard said, flicking his dark eyes from side to side in a comically paranoid furtive glance. "It's what Beetles do."

Teresa sighed and rested her chin in her hands. "Oh, I'm sure he thinks of it as keeping an eye on us."

"And lucky for you, Eduard, if you were in trouble," Garth said.

The music faded before swirling into a new mix, and the surrounding conversation grew louder. Three effete faux-intelligentsia at a nearby table continued their argument with much gusto and little actual information.

"You have to look far enough back to the precedent in mental development." The man waved a pungent purple cigarette back and forth. "Way back at the dawn of time, the human race went through a 'bicameral revolution,' when our minds split into left and right hemispheres." He crushed out his cigarette with finality and a smug expression. "This is a similar evolutionary step, consciousness becoming detachable from our physical brains."

A second young man drained a flowery-scented drink to fortify himself and launched into a counter-argument. "Makes more sense to say the whole hopscotch-thing was triggered by generations of people uploading and downloading to old-style computer networks and virtual reality environments. *That's* how personalities first became detached from the body. Now we can do it all the time."

Garth, Teresa, and Eduard met each other's eyes, smiling as they shared the same thoughts. They'd heard all the theories a million times before. None of them knew the true explanation, nor did they care.

Eduard rocked back in his chair, raised his voice, "Yeah, right—what if it was just from too much astral projection without using proper precautions?" The whip-thin intellectuals looked sourly at him for squelching their continuing argument, then turned to debate even more esoteric matters.

From a substation in their table, the bartender's remote eye popped up. "Sorry I didn't say a personal hello as soon as you came in. I got caught multiprocessing a large crowd. Can I get you three a second round, on me?"

"Yes you can, Bernard," Garth said immediately, glancing over at Eduard's slushy blue drink, now in front of Teresa. "And give us *each* something we've never had before. New experiences." He smiled archly. "Variety—the spice of life, right?"

"I'll dig deep into my lexicon," the bartender said with a wink of his remote eye. "Just stay friends, all right? You three are an inspiration."

"In a changing world, some things never change," Garth commented.

When the drinks arrived, Teresa raised her eyebrows at her two best friends in the world. The three had been inseparable since they were kids, abandoned by their biological parents, taken in and tended by the intense, warm-hearted Splinter monks at the Falling Leaves monastery.

She held up her glass in a toast, not daring to ask the contents of the new cocktail the bartender had created. "To friends," she said.

They all drank.

–1–

Hiding together in the protective doorway of the Falling Leaves monastery, young Garth and Teresa watched the wall of storm sweep toward them. Eduard dashed out into the open, a child hopelessly trying to dodge

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raindrops, then hurried back to shelter, brushing the wet off his loose brown jumpsuit.

The localized weather disturbance was a gray fist wielded by the angry computer/organic matrix. The storm appeared to be directed toward a specific section of the city that had displeased COM. The monastery just happened to be in the wrong place.

"Look at that," Garth said, then took a deep breath. "Smell the air—like wet metal."

"It's called ozone," Eduard said, his rain-spattered cheeks flushed.

Out in the streets, scattered pedestrians and late-for-work businessmen ran for the tall buildings, while forlorn street vendors rolled up their awnings or stood by their kiosks and stared, hoping the usually benign weather control would divert the wind and rain. Paper debris and dried leaves scratched across the sidewalks, gusted by the freshening breezes.

Teresa peered around the old red brick lintel posts, brown eyes wide. A brisk blast of wind ruffled her auburn hair. "Oh, the rain'll wash everything clean. Wouldn't you like to just stand under it until you're drenched?"

"Soft Stone would never let us." Eduard brushed a few droplets from his sleeves, then lounged against the brick lintel post, as if nothing bothered him, nothing affected him.

"Absolutely right, child." The bald female monk stepped silently up from behind, startling them. In the shadows of the entry hall, Soft Stone's eyes were bright and blue, her features blunt, her mouth generous and gentled by a contented smile. "Don't worry about the upheavals outside. Nothing out there concerns you." She turned them around, gently nudging their shoulders. "Come in, where it's safe."

Sheets of rain poured down several blocks away, spreading along the streets like an advancing forest fire. "Did some terrorist group try to sabotage COM again, do you think?" Teresa asked, looking to Soft Stone for an answer. The Splinter monks seemed to know everything.

"Yeah, and COM's using the weather controls to strike back," Eduard said.

"The Beetles should just arrest them," Garth said. "Then everything could be quiet and happy again." BTL operatives rarely let a situation get out of hand.

"Don't talk to me about the Bureau right now," Soft Stone said with uncharacteristic sourness in her voice. She drew her sky-blue robe tight around herself. "The BTL causes enough trouble as it is." Her broad, callused hands drew her sixteen-year-old wards back into warm shelter.

Outside, the rain struck against the closed door with hard fury.

The monastery was an ancient building embedded in a section of modern city structures like a fossil in limestone. The exposed walls of red brick had been weathered by the passing years. In simpler times the place had been a brewery.

Newer buildings with connective atriums and cliffs of mirrored windows had grown up around the monastery like younger trees engulfing a deadfall. But the Splinter monks had kept this building intact, repairing every wall, every structural support.

Inside was a maze of rooms, corridors, meeting halls, and privacy chambers. Garth made his way back to a cozy discussion alcove furnished with worn cushions, water pitcher, and curtain. Seated cross-legged on a tattered plaid pillow, Kanshah had already lit a pair of scented candles, a spicy mixture of cinnamon and spruce. The flames would provide a stuttering yellow glow for Garth to read by. And of course he had brought the book.

Clearly nervous about the testing ordeal he was scheduled to endure in a few hours, Kanshah smiled shyly at Garth. He held up the heavy tome,

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David Copperfield. A scrap of cloth served as a bookmark. "Let's do another chapter. It'll settle my mind. For tonight."

Kanshah was thin and meticulous, with mouse-brown hair and watery-gray eyes. His loose-fitting clothes were freshly laundered, his sash neatly tied. Older than Garth by a year or so, he greatly admired the blond young man who read to him patiently, savoring Dickens's descriptions, the ironies, the exotic characters. Old books had opened up worlds for both of them that the meticulous COM-database studies of the Splinters had never revealed.

Garth took up his own cross-legged position across from Kanshah, in the glow from the two scented candles. His fingers slid down the bookmark and flipped open to the proper page. Time to continue the story.

All the children in the Falling Leaves were wards of the state, given up by parents who felt no obligation to babies born from bodies not their own, or impregnated during flings after which the original minds had hopscotched to somewhere/someone else. Supplemented by their own income, the monks received government stipends to teach and raise these young charges, and they took their obligations seriously. Each monk was assigned as mentor and teacher to a group of children who had no identifiable parents.

Raised together within the monastery walls, Garth, Eduard, and Teresa had been inseparable since their early years, and they had now nearly reached adulthood. The ID patch grafted onto the back of his right hand would soon be put into service, once he learned how to hopscotch.

Garth's attachment to Kanshah was relatively recent, a result of their mutual interest in the old stories. But Kanshah would have to leave the monastery soon.

Garth read the words on the page, changing his voice to imitate the various characters. Kanshah watched him, drawing his bony knees up to his chest. He listened with rapt attention to the story, and his anxiety seemed to ease.

Moments later the limp curtain was drawn aside, and Soft Stone pushed her shaven head inside. "I saw the candles, Kanshah, and I thought for certain you would be meditating."

Garth closed the heavy book, abashed. Kanshah played with his fingers, reluctant to answer her.

Soft Stone wrinkled her forehead. "Your demonstration is this evening, child. Are you so confident that you don't need to gather your thoughts and prepare?"

Kanshah drew a deep breath and looked at the monk. "No. I'm very intimidated. But I like the way Garth reads to me."

"Then perhaps he'll take the time to read to me, too. Come along, Garth. We need to leave Kanshah to practice his mental exercises. None of my wards has failed in all these years, and I don't intend for him to be the first."

Kanshah looked sadly at the bookmark's place, only two-thirds of the way through the pages. "We never would have finished anyway."

Against the background whisper of continuing rain, Teresa could hear the bustle inside the monastery, the movements of people, conversations muffled by walls, the sense of life all around.

She found a place to be alone, a place where she could contemplate. Though the Splinters did not raise their wards to espouse any specific religious dogma, they did teach their students how to think. "Questions are more important than answers, child," Soft Stone was fond of saying.

She curled up on a well-varnished window seat, leaning her back against the brick walls and looking out through the sheets of rain. The glass panes vibrated with the hum of the downpour. She could see forms still out on the

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streets, hooded people trying to cover their placards and literature before rushing for shelter.

Teresa had watched other religious groups before, proselytizers handing out free leaflets. They tried to sell trinkets and second-hand possessions to raise money, liquidating worldly goods to scrape up enough credits to print more leaflets for a wider distribution, since they didn't trust anyone to notice their musings in the data ocean of COM. Their devotion and convictions fascinated her. Teresa's own meditations always raised more queries about the nature of existence and provided few hard facts.

The Splinters themselves had coalesced from the fringes of various religions, panicked believers who no longer knew what to believe. With its rapid development and evolution, the computer/organic matrix became so all-pervasive that some considered it a benevolent deity watching over the world; others saw COM as an insidious Big Brother; others just used it in their day-to-day lives and paid no more attention to COM than to the air they breathed.

Add to that the human ability to hopscotch. The shift had spread like wildfire in only a few generations, turning inside-out all perceptions of reality and the individual soul. Even street-corner philosophers had been thrown into a tailspin.

Over more than a century, numerous new fusion religions had sprung up, people experimenting with beliefs and seeking new answers with a millennial fervor. Body-swapping and COM had changed humankind more than anything in a thousand years—yet, none of the great religious texts addressed the issue. Even followers of the vaguest notions of Nostradamus couldn't find the slightest hint. How could any true prophet worth his salt miss something *that* important? Impossible. The doubts cast many zealots adrift.

Teresa touched her fingers to the window, feeling the cold of the rain through the glass. She was glad that other people could cling to beliefs strong enough to work for. She admired devotion so great that they would stand out in the rain and struggle against a vengeful COM-induced storm.

Now, though, even the most faithful rushed into the tall buildings, under awnings or overhangs, into lobbies. Alone and distant, Teresa sighed as she watched them go. It seemed even their beliefs weren't enough to protect them.

In the attic of the old brick monastery, under cramped ceilings and surrounded by air thick with damp and mildew, Eduard watched the downpour with his older friend Daragon. With a grunt, he forced the crank on an old half-circle window with a wrought-iron frame. Fresh wet wind gusted through the opening.

"Go with me. We can slip outside, no problem," he said to Daragon. He thrust his face out into the breeze. "Hop on the roof, then make our way over the eaves to the tube walkway on the skyscraper next door." Daragon looked at him with alarm, which prompted Eduard to continue with greater enthusiasm. "Hey, this is the biggest storm I've ever seen, and I want to go outside in it."

"But you'll get soaked." Daragon shook his head. "Why would you want to do that?"

Eduard snorted. "Look, I'm already sixteen and, we should be able to experience a few things when we want to. You're even older—where's your sense of adventure? Take a risk or two. Come on, let's go out there."

Daragon shifted uneasily next to the open window. He was small in stature, wiry. He had dark hair, dark almond eyes that flashed in the light as his gaze moved from item to item. "Soft Stone told us to stay here, to get ready for Kanshah's ceremony tonight."

"Yeah, right—that's hours from now.

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You're just making excuses." Eduard drew a disapproving breath and dropped his bombshell, knowing it would upset Daragon. "I thought you wanted to be my friend. Friends *do things* together. Come with me, just for a little while."

Though younger, Eduard was like a big brother to him, someone who had the brashness to do the things Daragon secretly wanted to do, but was afraid. "We shouldn't. Soft Stone laid down the rules, and we agreed to follow them."

"Rules!" Eduard snorted again. He saw the vast city—and beyond that, the entire world—waiting for him outside the monastery walls. He couldn't wait until he passed his tests, and got a chance to make his own way in life. He was sure he could survive with his own wits and a few resources. "Bend a few rules, Daragon. Run out in the rain, let your clothes get wet. Who's it going to hurt?"

Eyes gleaming, Eduard gestured toward the edge of the rooftop. Raindrops ricocheted in through the narrow window opening. "Look out there, see those shadowy strangers huddled under porches, eaves, awnings. Who *are* all these people? What are they doing there?" His voice became breathy. "Think of all the secrets they must have. They could be *anybody*. Impersonating anybody. Who would ever know?"

Daragon squinted his almond eyes in a puzzled look. "Impersonating? They've all got ID patches. Besides, can't you just . . . *see* inside to who they really are?"

Eduard looked at his companion, exasperated but not knowing what Daragon meant. He leaned out the half-circle window, into the downpour, mentally choosing his route across the rooftops. "Look, are you going with me or not?"

Daragon swallowed hard. "No. I'll just stay here."

"Suit yourself." Eduard left him behind, ducking out the window and onto the wet roof tiles.

Much later that evening, after the storm fury had passed as abruptly as if it had never been, the monks and all their children gathered in a brick-cold meeting hall that had once been the ancient brewery's shipping area. A gentle, natural patter of rain continued to douse the streets.

Garth found Teresa and Eduard, and they sat together on the concrete floor, sharing a thin blanket. The monks had lit numerous candles and augmented the flickering light with stepped-back glowtiles in the ceiling. Eduard's dark hair was dripping wet, his face flushed from his escapade out into the storm. The thin blanket soaked up the moisture.

Garth whispered, "Today I heard of a woman who tried to hopscotch with her dog. She was all alone, had the pet for years and years, and she wanted to give him a chance to be human for just a little while."

Eduard groaned. "I know where this is going. . . ."

"She ended up nothing more than an empty body, discovered only because the starving dog kept barking and barking."

Teresa sat astonished. "Do you think it was the slippage disease?"

"No, it's because she was stupid enough to try hopscotching with a dog," Eduard said.

Garth shifted uncomfortably, looking around the meeting hall, anxious for Kanshah. Teresa knew what was bothering him and laid a warm hand on his wrist. "He'll do fine, Garth, don't you think?"

"I know he will." Garth finally saw his older reading companion led into the room by a solemn-faced Soft Stone. "It's just that . . . I'll miss him when he goes away." Teresa squeezed his hand with compassion.

Kanshah came forward meekly, walking beside the monk. He looked around

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as if in search of Garth for moral support, but their eyes never met. Garth hoped the time spent reading to his friend that afternoon wouldn't give Kanshah trouble when he most needed to concentrate. Once learned, this was supposed to be a natural, instinctive act.

Soft Stone did glance in their direction, but gave only a flicker of disapproval at seeing Eduard's wet and bedraggled appearance. Her attention returned to Kanshah. She took the young man's narrow shoulders in her grip and turned him, displaying him to the audience. Then she faced him herself, staring deeply into his watery-gray eyes.

"Kanshah, you have reached the age at which your soul is strong enough to live on its own. Thus, so can your body. Demonstrate for all here to see."

He swallowed hard and reached up tentatively to touch Soft Stone's shaven temples.

"I don't know why they have to make such a big deal about it," Eduard muttered in a whisper no louder than a breath. Out in the rest of the world, everyone learned to hopscotch in the normal course of growing up, accepting it as a part of maturity.

From opposite sides, Teresa and Garth both nudged him to keep silent.

In the middle of the hall, Kanshah's eyes locked with the monk's bright blue gaze. He took a deep, heavy breath—and a flicker seemed to pass between them. Instantly, the demeanor of both people *changed*. The young man took another breath, quick and sharp this time. He straightened his shoulders and gave a proud smile.

At the same time, Soft Stone's body shuddered. Her eyes went wide with fear and awe. The sinewy hands fluttered over her body, touching her smooth head, her small breasts, her crotch. She looked around the audience in the brick-walled meeting room, amazed. Her eyes locked with Garth's, and she blinked hard, several times.

"I . . . I don't think I like this," she said, her voice different.

"You don't like my body, child?" Kanshah's mouth said with a chiding tone.

"No . . . I'm sorry. I didn't mean that." The old woman took a few faltering steps. "I just need to get used to this. It's very strange."

Kanshah's right hand raised, turning the dull ID patch toward the monk, then he picked up Soft Stone's limp arm. The young man pressed the square filmscreen on the skin against the corresponding ID patch on the old woman's hand. The filmscreen flickered, and Soft Stone stared down at the new identity displayed there.

"A perfect transfer." The young man spoke with a cadence and inflection that Garth recognized from years of lessons from Soft Stone. "Normally, it takes some time to accustom yourself to a new body. Think of it as breaking in a new set of shoes."

In Soft Stone's old but vigorous female form, Kanshah flexed his arms, turned around again, gaining better balance and control. The other monks smiled proudly, nodding in their sky-blue robes.

In the young man's body, Soft Stone stepped forward, looking at the audience. "This is just our demonstration, which you have completed successfully. But I am fond of my own body, child. Can I have it back, please? You've proved yourself to us."

Again their eyes met, again they touched. They pressed ID patches together a second time, reset their identities. Kanshah heaved a sigh of relief when he caressed his own body once more. "I think I like mine better, too. I'm . . . used to it."

Some of the monks let out a quiet titter of laughter. The younger children moved restlessly, striving to sit still on the cold concrete floor. Monks tried to shush them. The younger wards were just at the beginning of the years of

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mental training, meditation, practice they would undergo at the Falling Leaves.

"You may stay in your own body as long as you wish . . . or trade to someone else for a time if you prefer," Soft Stone said to Kanshah, smiling. "Hopscotching is like sex—you *can* do it with anybody, but most people don't." Gripping his shoulders again, she turned him to face the students in the wide, echoing room.

Soft Stone hugged him. "I hope I've raised you well. I've given you all my love and care, and now you are ready to go out into the world. I can't even call you 'child' anymore." She gave him a papery kiss on the cheek.

"Take what you have learned, and do what you can to make this city, this land, this planet a better place. And live your own life." Garth noticed to his surprise that tears now ran from her clear blue eyes.

"I will," Kanshah promised, his voice thick. "After the rain."

–2–

Afraid to go beyond the doorway of the Falling Leaves, Garth stood beside Eduard and Teresa. He watched with a heavy heart as Kanshah walked out through the main arch, leaving the monastery forever.

Sunlight dazzled from the reflective windows of the skyscrapers and connecting walk tubes. Like iridescent insects, hovercars rode on invisible COM-guided impedance paths through the sky. The day was so bright and colorful, it seemed an auspicious beginning for the young man's new life.

Apparently, the computer/organic matrix had achieved a victory in its dispute with hidden antitech terrorists. Garth wondered if that meant BTL operatives had already apprehended the troublemakers.

During his years in the Falling Leaves, Kanshah had accumulated few possessions, so he had little to pack. The monks gave him a small stipend to begin his life out in the real world, enough for him to get established. He was a new soul, a fledgling cast from his safe nest.

Straightening his back, Kanshah walked out into the bustling streets. He looked over his shoulder three separate times before he finally set his gaze forward and strode away into the metropolis. . . .

Soft Stone stood in the entry hall behind Garth, Eduard, and Teresa, hovering over their shoulders, as if trying to keep them from growing up. Daragon pressed close to the old monk in the passageway, but he could not get nearer to the three companions.

She set her square jaw and herded Daragon back into the monastery. "Come, child. We have much work to do. You are behind even the young children in your mental studies. Perhaps today we'll make a breakthrough and you'll finally understand." Leaving Garth with his two friends, the monk called to Teresa, "Don't forget our planned study and discussion later."

"Oh, I'll be there. I promise."

After Soft Stone and Daragon had left, Garth asked, "What do you want to do when you get out of here?" Kanshah remained heavy on his mind.

"It seems so strange out there," Teresa said. "Frightening."

"Or exciting." Eduard was the only one who saw the possibilities, taking one last glance outside before they closed the heavy wooden door. "I can do a thousand things, if only I live long enough."

On her way to the immense library, Teresa passed the monastery kitchens, the clanging of pans and pots, the hiss of fires and heating elements. She heard the happy chatter, smelled hot sesame oil and spiced vegetables. Though not actually hungry, she thought of the vegetables and thought of how pleasant it would be outside in the muddy atrium

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gardens, tending the plants and flowers. But she had promised Soft Stone she would spend her time today in intellectual pursuits.

The monk met her at an intersection of corridors, arms crossed over her blue-robed chest. Teresa had lost track of the time and was probably late, but she had never known the old woman to be anything but a patient teacher. "Is your mind ready, child? Ready for more knowledge?"

"I wish you would help me find some answers, instead of more questions."

Soft Stone chuckled. "You're assuming I have answers to give you."

The Splinters devoted themselves to raising the castoff children who had no definable mothers and fathers, born from bodies no longer inhabited by the minds who had been inside when they originally got pregnant.

Splinters considered such children to be entirely new souls, new flames, and therefore something special. The monks shepherded their wards toward their full potential, teaching them how to sift through the esoteric knowledge buried in COM, how to hopscotch. To them, mind-swapping provided a wonderful proof. It showed indisputably that the soul, the personality, was not part of the body but merely a *passenger*.

Soft Stone was the first to admit that she didn't know God's particular plan for these special children; she would not second-guess divine judgment.

"Are you saying we are destined for greatness?" Teresa had asked once.

"Who are we to define greatness, child? You will do what you will do—change the world or just change a life. That is up to you."

She thought of Kanshah, now trying to make his own way in a strange and unknown world. "What about finding a job?"

"That is not our task." Soft Stone sounded distracted. "Everyone can do that."

As they walked down the halls of the old brewery building, Teresa was startled to see a dark-uniformed BTL sergeant standing outside the office of Chocolate, the head administrator of the monastery. Teresa had never seen Bureau representatives inside the Falling Leaves, and she'd never before heard mild, soft-spoken Chocolate raise his voice.

"Absolutely not!" the head monk said to someone else inside his office. "We do important work here." Teresa could not see who he was talking to.

"Importance is a relative thing, sir. Many would say the work of the Bureau is even more important." The voice was calm and melodious, each word carefully enunciated. "And our needs must take precedence."

"The monastery is ours," Chocolate insisted. "We have lived and worked here for over a century. Find some other place."

"Please, sir, uh, Chocolate, let us be realistic. You have no way of fighting the BTL, if we should determine —"

Standing rigid outside the door, the BTL guard watched Teresa and Soft Stone.

Teresa looked up at the bald woman with deep concern. "What's going on? Why is Chocolate so upset?"

Soft Stone sighed. "I want you to be inquisitive, child—but some questions should not be asked." She put a firm hand on the girl's shoulder and hastened her along. The monk's sky-blue robes and Teresa's loose, comfortable clothes whispered along the hard floor.

Teresa dodged the subject and tried to approach the topic from a different direction. "It seems odd, though, don't you think? Chocolate got his name because he's smooth and subtly pleasing—you said so. But he just sounded so angry."

The roly-poly administrator was unambitious but competent. He spent his time waiting for the next cycle of life to begin, feeling no need to accomplish

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everything in this lifetime. He would have many more opportunities on the Great Wheel of Life.

"Some chocolate can be bitter as well, child," Soft Stone said with a wry smile. The old monk herself had been named because of her contradictory personality: she could be as soft as butter, or hard as granite. But out of soft stone came strength, the raw material for beautiful sculpture.

"I've been trying to think of what name I should take for myself," Teresa ventured with a tentative smile. "I mean, when I take my own vows in a few years."

Soft Stone paused in her tracks on the way to the library. "Don't talk so rashly." Her voice held a tone of rebuke. "When the monks choose a name, it's a solemn occasion, not a joyous one. We hold a quiet funeral ceremony for the person who forsakes the outside world, before we celebrate the rebirth of one who stays inside the monastery walls." Her blunt-featured face hardened, her forehead wrinkling as she looked down at Teresa. "We fervently hope our trainees will *not* stay with us, but go out into the world to become part of the connecting tissue of society. Your goal is to make this life as kind as possible for as many people as you can. And you can't do that from within these walls."

Hot tears came to Teresa's eyes. "But I thought it would be best if I—"

"We're not looking for new members. Child, only our failures remain here. Those of us who could not fulfill our life's work in the outside world."

Teresa couldn't believe what she was hearing. "Oh, but you're not a failure."

"I never achieved my full potential. I lived outside for years, experimenting, testing, hopscotching. Call it the brashness of youth, the pain of foolish love, but the fact is I fled back here, and I have felt like a coward ever since. Today, my only success comes from knowing that the students I teach will go out and do greater deeds than I ever managed."

She looked down at Teresa, her clear blue eyes moist. "I don't want you to take my way out. You are a new soul, a special child. You have so many more important things in store for you. Find your answers elsewhere, Teresa—but you must prepare for that day."

The library was one of Teresa's favorite places. The monks had completely redecorated and revamped one area into a museum of old books, kept more as pieces of art than as instructive tomes. Magnificent paintings, tapestries, and sculptures adorned the alcoves; the monks believed that students could learn as much by studying artwork as by delving through encyclopedia files.

Most of the work, however, was done on a labyrinth of COM filmscreens and access terminals, both voice-activated and direct-interactive. Based on organic neural-network circuits, COM was the circulatory system that ran through society. It performed the functions that everyone saw and used but never noticed: turning on street lights, circulating the air in buildings, monitoring impedance paths through the airways so that traffic flowed smoothly and safely, maintaining stable weather patterns via climate-control systems. COM held financial accounts, personnel records, and information libraries. Here in the library, a few hardworking monks assigned to database duty performed menial computer tasks for outside customers, earning money that went into the coffers of the Falling Leaves.

Students, though, were encouraged to branch out and investigate unorthodox connections, relationships between people and events, history and the future. With each generation, the Splinters believed that humanity must grow stronger, must improve itself. In the same way a muscle grows stronger only through exercise, people should actively attempt to better themselves, to understand the Universe around them.

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But sheer data by itself was useless. It had to be processed, digested, and taken into each person. The monks imposed a regimen that every hour spent delving through COM be matched by another hour contemplating the new facts, and then a further hour of discussion and sharing with others. "Information and knowledge are two different things," Soft Stone had often told her.

The monk led Teresa to a milky-white touch screen, a translucent interface with the pervasive information system. Soft Stone touched the field with her fingertips, and the milky surface shifted to mother-of-pearl, then opened into a complex data/subject map. "There you are, child." Even Soft Stone looked at it with awe.

"Can COM give me the answers to why I'm here?" Teresa asked. "Like, what does it all mean? What I should do with my life?"

The computer/organic matrix was an enormous passive mind. With its thinking power equivalent to billions of minds, with eyes that could watch over even the smallest sparrow, the Splinters saw COM as a manifestation of God come to Earth—a neural network peopled by the numerous souls who entered and never came back because it was too tempting to stay there. . . .

Soft Stone touched the information outlet. "Of course, child. Inside here you can find Heaven."

—3—

Attic room, dusty shadows, the scent of mildewed rafters like a moist forest floor. Ancient papers, boxes filled with mysteries. . . .

The brewery/monastery was so large that Eduard had convinced himself the monks barely remembered the room at all. He couldn't picture Soft Stone or chubby Chocolate squeezing into the crawlspace above the cleaning closet. Rung after painted metal rung had been mounted into the sloppily mortared brick wall, under the topmost eaves. The Falling Leaves had many forgotten spaces, little rooms, sealed closets—and the monks were too few or too incurious to investigate them all.

Daragon still followed Eduard like a puppy, eager to do things with him, but still uneasy about breaking any rules. The half-circle window leading onto the rooftops remained ajar from Eduard's rainy adventure a few nights earlier. Now a shaft of sunlight spilled in like melted butter; tiny dust motes sparkled in the air.

They had no studies assigned until late that afternoon, and both of them had done their chores at daybreak. "Soft Stone will never bother to track where we are. No problem. *Now* will you go with me into the city?" Eduard said, already prepared to heave a sigh of disappointment. "There's so much to explore."

Daragon's eyes flicked back and forth, searching for excuses. "Why me? Why doesn't Garth go with you?"

Eduard shrugged. "He wants to stay inside and work on some kind of secret art project." Though skeptical, he took Garth's wishes at face value. Daragon, though, wouldn't get off the hook so easily. "I want you to come with me. I can show you some great places."

"But what if we're caught?"

"Then we'll get sent back here. And if we don't go, we'll be stuck here anyway." Eduard swung open the wrought-iron window frame and drank in a deep breath of the bright air. "Besides, I want to get something for Teresa. Something special. Don't you want to help me? For her?"

And with that, Daragon was helpless. He wanted so desperately to be with Eduard and always looked so longingly at Teresa. Eduard used the knowledge without mercy.

Without looking back, he slipped through the window like a cat and dropped onto the rooftop with Daragon at his heels. Glancing down, he saw the streets four stories below—and was tak-

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en aback to see two BTL patrols stationed in clear view of the monastery. The Beetles did nothing threatening, barely even moved, simply made certain their presence was visible.

"Hey, what are they doing here?" Eduard asked. "They seem to be paying a lot of attention to us lately."

"Maybe the Bureau is just protecting us. Remember the storm, and those explosions last month."

"Protecting us? Yeah, right." Eduard snorted. "Just don't let them catch us now."

Keeping low, they scampered along in the sunlight, confident of their footing, over to where the old brick wall pressed against a new structure. They climbed an access ladder onto a connective walkway, then scrambled into the neighboring high-rise.

Daragon nearly stumbled, unaccustomed to the moving mechanical walkways inside the strange modern building. Eduard propped him up against the press of pedestrians, couriers, business people. He and Daragon wore plain brown clothes, unremarkable, unnoticeable.

A woman strutted by dressed in scarlet, surrounded by a haze of spicy perfume that was both provocative and stifling. A squat man with drab clothes and a clunky body that smelled of sweat worked at cleaning the curved transparent walls on the high walktube.

Daragon had been outside the monastery before on specific errands, but never without an attentive escort. Never unbridled. Eduard reveled in the risky freedom, but tried to cover his sense of wonder with a blanket of nonchalance.

They took a stairlift up to a level with polished synthetic stone floors and windows filled with sparkling merchandise. The galleria held shop after shop of jewelry, trinkets, clothes, candles and ornaments. Upscale showplaces held sculptures, some of them holographic and some fashioned out of dried stone-gels. Sensory fountains splashed hypnotic music and light into the air. People milled about, not even noticing their surroundings.

Daragon could barely walk, absorbed in everything he saw. "Are we going to get something for Teresa here? Would she want any of these things?"

Eduard laughed and clapped his companion on the back. "Yeah, right! Not this stuff—we don't have any credits to buy it with. Besides, Teresa wouldn't know what to do with jewelry or a holographic sculpture." He took Daragon by the arm. "Come on, let's take the descent tube down to street level. That's where we'll see the really interesting things."

Outside again, at the lowest street level, Eduard stared up at the towering buildings all around, a forest of mirrored glass, polished stone, gleaming metal. Walls were colored with fingerpaintings of chameleon pigment or daubed with neon tracings. Elevators rode on the inside and outside of skyscrapers like deep-sea diving bells.

Greenways ran down the centers of the boulevards, adorned with trees and flower boxes and fountain/irrigation systems. Higher up, between the buildings, hovercars skimmed across the skyways in an orderly fashion, guided by COM flow control. With little ground vehicle traffic, the streets were the domain of pedestrians.

Eduard pointed to a lonely-looking recruiting station next to a line of exotic food vendors. "What do you think, Daragon? Should we go join the Defense Forces?" He couldn't even begin to imagine Daragon as a soldier.

Eduard had recently watched a popular entertainment cycle, a heart-wrenching war story about brave soldiers during one of the major mid-twentieth century conflicts. A great general had been mortally wounded during the height of a battle, and all looked lost. Knowing the fate of his comrades was at stake, a quiet infantryman (who had

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been a coward through most of the story) selflessly sacrificed himself by hopscotching with his general, dying in his place so that the military leader could lead the troops to a spectacular victory. Great drama.

Eduard thought, however, that the twentieth-century wars had occurred long before anyone had learned how to swap minds. Such historical details didn't seem to bother the entertainment industry.

"But why would I want to be a soldier?" Daragon asked, genuinely perplexed. "What do we need to fight for?"

Though Eduard paid little attention to current politics, he vaguely knew about the economic golden age brought about through the pervasive efficiency of COM. The computer/organic matrix ran day-to-day details of the metropolis far better than human committees and workforces ever could.

Farther down the street, he and Daragon stopped in front of the bizarre and compelling edifice of Club Masquerade, a mind-boggling swirl of lights and sounds and tantalizing glimpses. As Eduard stepped onto the sidewalk, embedded panels lit up glowing score numbers in a dazzling retro-imitation of a child's hopscotch game. Captivated, he looked at the unmarked arches that led into the Club. "I don't suppose we're old enough to go in there. Not until we learn how to hopscotch."

Daragon's eyes narrowed with distress. "Stay away from that place, Eduard. There's too much chaos, a haze of body-swapping and strange people."

Eduard shrugged. "Sounds exciting to me. Think of all the opportunities."

They sat on a sun-warmed flowstone bench, partly to rest but mainly just to watch the world. Eduard stared across the greenway, where sycamore leaves fluttered in a faint breeze; a young man sat under the tree, studying some sort of hand-held game. Two skaters coasted by, hand in hand. Shadows flickered like strobelights across the sunlight as a broken string of hovercars hummed overhead.

Eduard watched people passing through the skyscraper doorways, friends chatting in outdoor cafes, suspicious shapes lurking in alleys or slipping quickly from beneath one awning to another. He watched a well-dressed man walk carefully and furtively, edging along the building walls. Eduard wondered if the man was unaccustomed to a new body, or if he had something to hide. . . .

"Hey, have you ever heard of the Phantoms?" he asked, startling Daragon.

"You mean, those . . . immortal people? It's just a myth."

Eduard pressed his lips together. "People who hopscotch bodies again and again in order to outrun death. They keep trading themselves into younger bodies, more healthy physiques. Staying alive. Doing whatever it takes. Sometimes they even have to steal bodies. Permanent transfers."

Daragon wasn't so credulous. "Nobody has any proof of that, Eduard. The Beetles would know about it, wouldn't they? Nobody really believes the Phantoms exist."

Eduard kept watching the furtive stranger until the man passed around a corner, lost in the crowd. "Well, I sure *want* to believe. Some of the Phantoms are supposed to be five and six hundred years old."

"But people haven't even known how to hopscotch for that long!"

Eduard refused to give up hope. "OK, so maybe the first Phantoms learned how to swap bodies decades before anybody else, so they had to hide their abilities, go underground." His eyes gleamed. "Maybe they kidnapped other bodies, swapped minds, and then staged the death of their old selves. No one would ever know."

For a true Phantom to stay alive for centuries, such a person would have to maintain an extremely low profile, a quiet existence, leaving no trail and at-

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tracting no attention. It sounded like quite a challenge to him, an exciting one.

Sitting on the bench, Eduard decided that he wanted to become a Phantom. The mythical group had beaten the system, and he wanted to follow in their footsteps. "It would be like a candle flame passed from wick to wick, never burning out, no matter how many lumps of wax you leave behind."

Daragon remained clearly skeptical, but could find no immediate counter-argument.

Eduard pointed to a stranger haggling with a food vendor across the street. "If they can doctor their ID patches, how would you ever know? That man there could be a Phantom." He indicated a woman climbing into her hovercar parked at a charging terminal. "Or *she* could be one. Or that other man with the green shirt. Or that old couple, keeping their heads down, just waiting for their chance to swap into new and healthy bodies."

Daragon eyed every person his friend pointed out, but shook his head each time. Finally, he said, "Can't you just . . . *recognize* people? See into their heart and soul?"

Eduard looked at him strangely. "Even the Beetles need scanners and equipment to figure that out."

Daragon focused on the strangers across the street. "I don't."

"Yeah, right."

For years now, Soft Stone had been troubled by Daragon and his inability to succeed in even the simplest of mental training exercises. He was so far behind his age group, she had begun to despair of him ever learning. Perhaps Daragon was just imagining a new skill, something he knew others couldn't do.

Eduard got up from the bench. "Let's go. We still have to find something for Teresa before we get back to the monastery."

Weaving their way across a crowded intersection, Eduard and Daragon both saw the flower market at the same time, and suddenly they knew that *this* was what they wanted for Teresa.

The open-air market was a profusion of colors and scents: bouquets of pink, white, and yellow carnations wrapped in green paper; long-stemmed roses as red as blood mixed with delicate highlights of baby's breath; tulips, daffodils, even exotic orchids. Gladiolas and hollyhocks stood out like spears of color. Genetically modified exotics stood out in a garish profusion of neon or metallic colors, selective scents ranging from peppermint to clove. Any combination was possible. Honey bees, unable to resist the enticing perfumes, danced through the air, sluggish with the heady abundance.

"But we don't have any money," Daragon whispered. Brought up in the monastery with all their needs taken care of, the two young men had no credits of their own. "How are we going to buy flowers? Will someone just give them to us?"

Eduard looked at him with scorn. "We wait for our opportunity."

They walked along the aisles of flowers, sniffing some, fingering others. The monastery had its own high-density garden in the inner courtyard, where the monks tended herbs and vegetables; but they planted very few flowers. Teresa loved to work with the plants, and Eduard knew she would delight in the transient, delicate beauty of these roses, or even daisies or carnations. He kept his eyes open.

Some of the daisies had been silica-enhanced so they would never wilt. A midnight-blue rose opened from a perfect bud to full bloom, then collapsed back into a bud again, cycling in a single minute. The day was peaceful and bright, the conversations and customers relaxed and friendly.

Then, when the substation explosion ripped through the air, the people were too stunned to show fear.

The unexpected blast tore a hole

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through the side of a building, two stories up, obliterating a COM traffic-control substation. Chunks of stone, glass, and hot metal rained down as bystanders on the street scrambled for safety. A restaurant's striped awning caught on fire.

With the disruption of COM, the interleaved skylanes of hovercars swirled like a stirred anthill, then safety systems kicked in, grounding most of the vehicles in a rapid precaution, filling the crowded streets.

The safety systems lost only one hovercar. Three stories directly above the wrecked substation, the topaz-blue vehicle veered from its impedance path, slipped through the protective electronic net, and plummeted like a juggernaut into the sidewalk. The topaz-blue vehicle scraped the side of a building as it fell, then exploded into a taqueria across the street from the flower market.

People screamed and ran about. Eduard could see the flaming hulk of the crashed hovercar, a mangled man trapped inside and flailing to free himself. Some ran toward the scene, some fled, while others remained frozen and watching.

Daragon couldn't believe what he was seeing. "It's the terrorists again!"

Thinking fast in the moment of utter chaos, Eduard snatched a mixed bouquet of color-coded carnations, chrysanthemums, rainbow-petaled daisies, and talking daffodils. He didn't have time to be choosy. Huddled around the flowers to block them from the view of the stall owner, he snapped at Daragon. "Come on, let's go!"

Daragon instinctively ran with him down the streets, but looked at Eduard in shock. "You didn't tell me we were going to steal anything."

"How else was I going to get them? What were you thinking?" Eduard wasn't without a conscience, but he did have his sense of priorities. "Besides, flowers grow free from plants—the vendors can just grow more, so don't worry about it. Remember who the bouquet is for."

Daragon swallowed hard, still reluctant. "All right, but *I* get to give her the flowers."

Eduard shook his head, not even willing to bargain. "You had your chance. You could have grabbed some for yourself. No problem."

In the end, they agreed to divide the spoils between them. With their prize flowers in hand, Eduard and Daragon raced back to the monastery.

—4—

In the basement of the old monastery building, Garth found his spot of hidden solitude behind the thick, long-unused pipes: a small utility closet that had been blocked shut when new plumbing systems were installed years before the Splinters took over the structure. This shadowy, timeless room had remained undisturbed since the building had been a functioning brewery.

Garth had found it, pried it open, looked inside.

Over the years as he wandered around the building, Garth studied the monastery's empty rooms and alcoves, using his imagination to envision chambers crammed with giant vats, boilers and fermenting containers, malting bins, roasters, and bottling lines, as well as a shipping room and business offices.

Down in this untouched cell, each wall only a couple of meters long, Garth could smell the *past*, mystical odors that reminded him of the Charles Dickens novels he had read to Kanshah and now had to enjoy by himself. Garth had kept this spot secret even from Teresa and Eduard.

But once his project was completed, he would no longer need to keep it to himself.

Even in childhood he had been fascinated by the artwork and sculptures that filled the monastery library, the dining hall, the corridor alcoves. All the

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colors seemed so intense to Garth, the shapes of the statues and paintings so sharp and complex, the details so intricate.

He could spend an hour marveling at the contours of a single sculpture, while Eduard would grow impatient after minutes, seeing what was there but unable to grasp anything more. Eduard had gone off with Daragon today, no doubt to do something brash and unexpected.

Teresa spent the afternoon in the library, searching for her own answers. She was the person most likely to understand the calling of art, he thought, and he would show the painting to her first.

Now, trying to repay the kindness of Soft Stone and the Splinter caretakers, Garth had taken it upon himself to paint a special mural covering the walls of the cramped utility room. He had created a wonder-filled scene from his imagination, based upon what he knew of the history of the Falling Leaves.

He had researched what he could find of old breweries, adding details from 19th Century novels. Ignoring the unevenness of the mortar and bricks, he had painted a winter scene that reminded him of classic Currier & Ives holiday prints. Horse-drawn carts pulled up to take large barrels of Trappist ale brewed by brown-robed monks who stood at the brewery's loading dock. Wagons dodged automobiles on the cobblestone streets. Portly men in top hats sang Christmas carols under a gas street lamp next to an elevated railway.

Garth made each detail as real as he could, using exuberant but unpracticed abilities as a painter. He had been working on the mural for weeks, originally attempting only a small idyllic scene, with only a few jars of paints he had found. But as he worked, he thought of more and more things to add, other characters, other buildings, thinly disguised renditions of the high-tech skyscrapers he could see out of the monastery windows. He kept intending to put finishing touches in place, to call his mural complete. But then he thought of just one more idea, and then another.

By the light of an unfiltered glowtile, Garth set to work, dipping his brushes in the swirls of color. He became engrossed in the world behind his eyes, bringing to life the panorama he saw in his imagination. He could almost smell the wet snow, the horses, the rich ale pouring into the oak-slatted kegs. . . .

"I cannot believe my eyes!" a firm male voice said, startling Garth so badly that he dropped his paintbrush. "Young man, what have you done to this place?"

Garth turned to see one of the monks, a stern weathered man named Hickory, hardened and strong. Before he could answer, Hickory's voice grew more strident. "I noticed the light down here, but I never expected to see . . . this! Who gave you permission?"

"I just wanted to create something nice," Garth said. "I'm almost finished. I was going to show everyone when I was done."

"Well, you shouldn't have started in the first place." Hickory crossed his arms over his chest. "Don't we give you enough chores to keep you busy? It's easy to see what sort of mischief idle hands can work."

Garth didn't know how to respond. "But . . . *look* at it. It's not vandalism—this is art."

"When you paint all over a wall you don't own, with no permission from anyone, it is called *vandalism*. Come with me. We'd better see Chocolate right away."

Unfortunately, the monastery's administrator didn't know what to do with him, either. So much of the children's training had been carefully planned, set forth according to an idealized schedule. The soft-spoken, round old monk seemed greatly distracted, his brow creased with worry, his shoulders

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sagging as if from a heavy burden.

"Oh, why don't we just let him paint scenes on *all* the walls?" Chocolate said with a hint of exasperation. Garth didn't think his own actions were responsible for the somber mood. "Maybe then the Bureau won't want this place after all. We don't have any other way to fight them."

"Sir!" the other monk said. "We can't encourage this sort of —"

Chocolate waved one of his pudgy hands. "All right, all right. This is really not a very good time, Hickory." He sighed, looking at the papers on his desk, the messages. "I suggest we merely have young Garth repaint all the walls in a plain color so that the room can be usable again, if ever we decide to use it."

Garth's knees became weak at hearing the devastating punishment, though no doubt the mild-mannered administrator had not intended it to be so serious.

"But . . . don't you even want to look at what I've done, sir?"

"No need," Chocolate said, already engrossed in a weighty, official-looking document on his desk. "I'm sure it's wonderful. You're a very talented young man, Garth, but you must learn to respect certain boundaries."

Now the beige paint smelled sour and acrid, and Garth swathed it on with a thick, inelegant brush. The horse carts vanished under a layer of drab tan. Rosy-cheeked Trappist monks continued to gulp their foamy brew as he painted right over their faces.

Garth paused, and the brush trembled in his hand. He managed to keep the tears balanced inside his eyelids, not letting them spill down his cheek. He dipped the brush into the bucket again, then swabbed across the rough bricks.

Hickory had spent the first half hour watching him in silence, not taunting him, just remaining firm and stern. Garth didn't argue with the monk, though he wished he had been able to show Eduard and Teresa before erasing his wall.

"That's very good, from what I can still see of it," Soft Stone said from behind him in the dim basement.

Garth took a moment to compose himself before he turned to face her. "You should have been here before I covered all the good parts."

"Your mural is still there, behind the paint."

He stood with the brush dripping round circles of beige on the floor. "But no one can see it. I can't show it to anybody. Isn't that what art is for?"

The woman nodded her smooth head. "In part, child. Art is about sharing and communication, yes, but that's not the only thing. Recall the concept of process versus product. Did *you* learn from it?"

He swallowed hard. "You told me to learn from everything I do."

"And?"

"And, yes, I learned from it, I suppose. I enjoyed doing it, too."

"Then it's not a total loss." Soft Stone smiled. "An artist needs to do more than just create scenes that are pleasing to the eye."

"How?" He glanced with dismay at his half-defaced mural.

"Use your art as a lens for viewing all facets of life. To draw or paint things, you can't just imitate what you see. You must first *understand* the things. Give your art a life of its own."

Garth didn't comment at first, brushing more thick paint across the bricks. With two strokes he covered part of a street. He had spent hours meticulously painting each individual cobblestone. Now, he obliterated them all in less than a minute.

"Would you like me to help you?" Soft Stone asked. "Together we'll be finished in half the time."

In all the years he had spent at the Falling Leaves, Soft Stone had never of-

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fered to help with his assigned chores. But it was hard enough to do this task, and Garth didn't think he could bear to watch another person paint over the scenes into which he had poured his efforts. It would be like watching someone else erase his very soul.

"No, I think I should do this myself. It's my responsibility." Then he paused and turned to look at her. "Besides, it'll give me time to think about what you said. About art, I mean."

Content, Soft Stone disappeared into the basement shadows with a whisper of sky-blue robes.

–5–

Teresa lay in darkness, surrounded by the peaceful sounds of sleeping companions: warm breaths, quiet snores, the rustle of blankets, bodies stirring under sheets. Her eyes were open, but she could see only vague forms, nothing clear and definite.

Like her understanding of life itself.

Next to her in the communal sleeping quarters, Garth breathed heavily, deep in his dreams, while Eduard tossed and turned on the other side of her, restless as usual. He had one arm sprawled on her narrow bed, and she touched the back of his hand, gently circling his dim ID patch. Eduard mumbled quietly, but did not awaken.

Daragon slept on the opposite side of the room. In an adjacent chamber, the younger children muttered, sound asleep; one whimpered quietly, perhaps after a nightmare. In the corridors, the monks moved about, watchful. Beyond the walls, the night city made its own music, completely separated from the world of the Falling Leaves.

Teresa lay awake, wondering, empty inside, needing something. . . . She blinked, but nothing became clearer. *What does it all mean?*

Here she was surrounded by people just like herself, young men and women she had grown up with, experimental lovers, or friends, or both. They had all been brought here as infants, like items donated for a white elephant sale. The monks accepted them as gifts, raised them without last names. They taught the children to develop their inner strengths, to know their minds and their bodies. Practical survival skills could come later, once they found themselves outside in the real world.

Teresa was curious about where she came from, why her biological parents had chosen to place her in the Falling Leaves rather than raise her. Here, none of her friends had a family, a background.

Garth and Eduard didn't worry about it. They lived for themselves, looking forward instead of back, without an undue fascination about their parentage; Daragon, on the other hand, was practically obsessed; in his private moments with Teresa, he fantasized quietly about his never-seen mother and father. He needed to know where he had come from, why he was different from the other children.

The almond-eyed young man was incapable of even the simplest mind tricks that the other trainees could do. Nearly a year older than Teresa, Eduard, or Garth, Daragon would soon have to face his mental testing, like Kanshah—and as yet he showed no indication of being able to hopscotch.

Teresa was worried about him.

In the dimness, she turned to look at her small bedside table, at the two crude vases—water glasses, actually—that held the separate, long-lasting bouquets Daragon and Eduard had brought her over a week ago. . . .

She recalled when the two had approached her, proud and beaming. They had jockeyed forward, each trying to be the first to hand her a colorful profusion of decorative flowers, more beautiful than any of the blossoms she had tended in the monastery garden.

"We got these for you," Eduard said, his voice low as he thrust the bouquet forward.

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"But you can't tell Soft Stone," Daragon insisted.

She had taken the flowers, sniffing the exotic perfume. They stood in a side hallway, next to an open window that looked down on the courtyard surrounded by mossy brick walls. Garth had been walking with Teresa, troubled inside, his clothes and hair smelling of fresh paint. Now he watched, content just to see Teresa happy.

"We thought you might like them," Daragon said, and Teresa was careful to take the flowers he offered with as much enthusiasm as she had taken Eduard's. "We really weren't supposed to—"

"We wanted to make you smile, Teresa," Eduard said. "And that's all that counts."

Delighted, she hugged both of them. She sat down on the flowstone window bench. Outside, she could hear monks and children pulling weeds, hoeing the dirt, ready to plant more vegetables.

Excited, Eduard chattered breathlessly about their adventures on the streets, while Daragon added his own impressions. He was still greatly shaken by the terrorist explosion and the hovercar wreck they had witnessed. "I wonder if the man inside survived," he said. "He looked very badly hurt."

"And I think we saw a Phantom," Eduard interrupted. He lifted his chin proudly. "*I* want to sneak around when I get out of here, swapping from body to body so I can live five hundred years."

Teresa frowned at him over the colorful flowers. "You want to become a Phantom just for the sake of adding years onto your age? There's got to be more to life than that, don't you think?"

Though they were her closest friends, Teresa felt somehow separate. She was the one who stared into the sky and looked at clouds, who pondered the imponderable. "What happens after death? Why are we here? Does what we do *matter?* Where do we go?"

She said carefully, "For every year you add to your own life, you have to take it away from someone else's, Eduard, by using their body. Don't you think?"

Daragon gave a solemn nod, but Teresa suspected he agreed with her out of habit. She often took him under her wing, because he listened to her complex spiritual ramblings, while Garth and Eduard didn't have the same patience or fascination. Daragon liked to hear her talk, but he didn't really understand either.

"I doubt that just surviving to a greater age will help me toward any kind of enlightenment," she continued.

Eduard looked uncomfortable. "Now you're talking like Soft Stone."

Garth looked out the window down into the garden. "Phantoms . . . The prospect is interesting," he said in a detached, somehow dejected voice. He found many new ideas interesting. "But since none of us are old enough to hopscotch at all, why worry about how many centuries you'll be able to do it?"

Eduard had been disturbed that his close friends did not see the obvious possibilities and the challenges. "We'll come of age soon enough. Then it'll matter."

Now, at night in the communal sleeping quarters, Teresa stirred, eyes wide. In the dimness she could discern the sleeping forms of Garth and Eduard, lost in their own dreams, their own worlds.

She envied both of them. It would be a long time before she herself got to sleep. . . .

–6–

The next morning, Soft Stone stood just inside the monastery doorway, blocking their exit. Sternly, she pressed her shoulders against the closed doors as she faced Eduard, Garth, Teresa, and Daragon. Only small amounts of light drifted through the narrow upper windows, leaving the entry hall in shadow.

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Eduard was uneasy, but curious as to what the bald female monk had in mind. Soft Stone had never acted this way before. Garth and Teresa looked equally perplexed, while Daragon seemed intimidated at the thought of what their teacher would do to them.

"You are all eager to explore the city, wondering exactly what's beyond the places we've shown you." Her smooth eyebrows arched, but her voice held a sharp edge, not entirely warm and understanding. "And at your age it's probably good that you learn . . . learn a lesson."

Eduard swallowed hard. She knew something.

"I need you to run an errand for me." She pursed her papery lips. "I'm sure you can handle it without an escort—correct, Eduard?"

"Uh, yeah . . . right," Eduard said, his ears burning. Garth and Teresa glanced at each other, then at him. Daragon blinked, as if hoping he might escape some dire punishment.

"I am going to give you some credits. Go out and buy flowers for all of the monks. Get several bouquets so we can brighten up the monastery. I think you know where to go, don't you?"

Eduard's stomach clenched, but he knew better than to lie in front of the old woman. "No problem."

"Take Garth and Teresa and find a particularly good flower seller. In fact, you may want to pay him a little extra for whatever you purchase today. Does that sound fair?" Her voice was hard, devastating. She *knew!* Somehow, she knew exactly what he and Daragon had done the day before.

"That would be . . . fair." He kept his voice even. He had stolen the flowers for the best of reasons. Teresa had been so happy . . . and it wasn't as if the flower seller had ever noticed.

But Soft Stone had noticed.

"And you, Daragon." She turned toward the dark-haired boy. "If you weren't so far behind in your mental studies, I'd make you go along with them. Instead, you're going to spend the morning with me, in intensive practice. Your testing comes very soon now. We cannot delay it much longer."

Daragon lowered his head. "Yes, Soft Stone."

The bald woman opened the heavy door, and a flood of daylight poured in. Eduard stepped forward, anxious to be away from the Falling Leaves—though it didn't feel much like triumph, now that the monk had actually let him go out and explore.

Directly in front of the old brewery stood a uniformed officer from the Bureau of Tracing and Locations. The Beetle turned and met Soft Stone's gaze with smug confidence and a hint of challenge.

The gently reproving and instructive expression the monk had used on her young wards suddenly changed to one of anger. "What are you doing here? This is our building. Leave us alone." She crossed her arms over her chest, and Eduard was startled by Soft Stone's quick vehemence. "Shouldn't you be out finding someone, or tracing a missing body?"

"I'm currently on routine duty," the officer said, his voice flat.

"Your purpose would be better served if you tracked down those saboteurs who blew up a COM substation last week. Two of my children were almost killed in that accident."

Eduard froze and looked back at Daragon, their eyes wide with guilt.

"We anticipate apprehending the perpetrators today," he said. "There is an operation pending." The Beetle turned back to face the streets, but he did not move away from the Falling Leaves.

"Stay far from him," Soft Stone said.

The Beetle didn't even waste a glance on the three sixteen-year-olds as they slid past him. The old monk clutched Daragon's arm and closed the massive door with a heavy thud. . . .

"This way." Eduard slipped past the

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Beetle. "I can show you where the accident happened last week."

"And don't forget the flowers," Garth added. "That's what we're supposed to be doing."

The tension passed as they walked down the boulevards, staring up at the unbroken flow of hovercars and connecting transport tubes. High overhead, skycraft etched white lines against the blue. The clouds were gone. Apparently COM had no weather dispute to offer this day.

Since they rarely set foot beyond the Falling Leaves, Garth caught his breath at the kaleidoscope of details, colors, smells. He was astounded by the architecture, the trickling beauty of fountains, the greenery of shrubs and trees. He and Eduard each folded one of Teresa's arms in their own, flanking her.

The inseparable trio walked unnoticed among the other pedestrians. Soft Stone had made sure they chose nondescript clothes, none of the robes or symbol trinkets the Splinters wore during ceremonies. Now they looked just like normal teenagers, though a bit more wide-eyed and naive.

Teresa noticed another group of religious followers, and she turned toward them, feeling a tug of curiosity. She wanted to talk to them, question them, learn about their philosophy. She wondered how their beliefs differed from what the Splinters encouraged, and what she herself had gleaned from searching through the monastery's great databases.

Eduard squeezed her elbow to his side and pointed, oblivious to her fascination with the group. "Look, that's where we saw the explosion."

The side of a building had been scarred with black flames and smoke. A blossom of windows had shattered around the midpoint of the blast. A crowd had gathered behind barricade tape to watch the crews cleaning up the sidewalks, repairing the torn and burned awnings. The taqueria hit with shrapnel was sealed up for repairs.

Mag-lock scaffolding hung on the sides of the skyscraper, while workers sliced off shards of mirrored glass, careful to store them in remanufacturing bins, so the deadly crystalline spears wouldn't rain upon the pedestrians below.

"Daragon and I saw the hovercar crash right there. You can still see where the pavement's been wrecked."

"Look at that." Garth stared at the site, deeply moved. Then he glanced at the cobblestones, seeing a damp and scuffed leaflet, a discarded tract that looked as if it had been printed on a hand-cranked press. *Stop COM Now! Become a person again!* Garth picked it up, disturbed and confused by the terrorists, perplexed as to what drove them. "I wonder what they really want." All the exclamation points hurt his eyes.

Eduard looked at him. "Some people are afraid of change, even if it increases convenience for just about everybody else. I think they want to destroy what they don't understand." He tore the paper out of his friend's hand, crumpled it. "Don't read that stuff, either of you."

"Let's get the flowers now." Garth's voice wavered as he turned his back on blackened scar of the crash site. "I want to look at something beautiful instead of destruction."

He sniffed and turned to find the small plaza filled with a jungle of cut blossoms. Perfumes and bright colors bombarded his senses, and he took them in stride, filing the details away as experiences to be remembered.

"Hey, you need both ends of the spectrum for a balanced picture of life," Eduard said.

"So let's get the other end of the spectrum," Teresa said.

They walked among the bouquets, the tall stalks, the ferns. Other customers selected artificially-colored daisies, sniffed carnations, haggled over roses. Behind the kiosks, workers

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arranged clumps of flowers, sorted irises by color, trimmed away drooping blossoms and placed them in organic recyclers. They wrapped up special floral arrangements, altered scents and grafted-on petals. They added ribbons, audio greeting buttons, sparkling crystals, or mirrored glass ornaments.

Eduard lowered his eyes in unaccustomed embarrassment when he saw the vendor from whom he had snatched Teresa's bouquet. The man glanced at him without the slightest pause. Eduard felt an electric shock pass through his heart, but the vendor didn't notice.

Uncharacteristically shy, Eduard selected several large bouquets from the vendor's shelves and nudged Teresa to do the same. Garth was puzzled that Eduard would choose so many from a single merchant, but the flower seller was delighted with the sales, especially when Eduard insisted on a more than fair price. The flower seller added a few extra stalks of magenta humming gladiolas to round out the purchase.

Eduard felt good after having made amends, though the flower seller didn't know what had happened. Teresa's arms were filled with a richness of flowers, and Garth smelled them, enraptured. Eduard breathed a sigh of relief, knowing Soft Stone would be proud of how he had handled the situation.

He looked up at the tall buildings—and was the first to see the gunmetal-gray BTL hovercraft cruise into position midway up the skyscraper. It hung directly above the flower market. "Hey, look up there. Something's going on."

Garth and Teresa watched as the ominous craft cruised down to a specific level in the tall building and maneuvered up against the mirrored glass. A rubber-lipped transfer tube extended, sealing itself against the window. Even from far below, Eduard could hear cutting sounds, grinding like saw-powered sharks' teeth. The Beetles had found someone.

Many of the customers and vendors in the flower market stopped to observe. The murmur of background conversation changed, like an indrawn breath.

Muffled by distance, Eduard heard a few faint projectile shots—but he couldn't tell if the weapons fire came from fugitives inside the domicile, or from the Beetles themselves.

Suddenly one of the windows adjacent to the besieged apartment smashed outward, a blast of small charges placed on the reflective glass. The entire window shot free, spraying shards to the streets below. Pedestrians screamed and ducked under awnings, kiosks, and tables; others didn't manage to escape, their arms thrown up for protection, their skin sliced by the broken edges.

Four people sprang out of the smashed window. For a moment, Eduard thought they were leaping to their deaths just to escape apprehension by the Beetles—but then he saw that they had attached snakelike cords to themselves, flexible rappelling ropes anchored inside the room. The four escapees flew down, magnetic pulleys humming as they plummeted to street level.

Above them, the BTL gunship opened fire with a cloud of stun projectiles, shattering other windows in the building. One of the escaping fugitives slammed against the skyscraper wall, leaving a splash of blood on the mirror-glass. His arms and legs hung limp, and he spun down, slowed by the automatic rappelling gears, still dropping like a counterweight.

The others continued downward, bouncing off the sides of the building, picking up speed.

Another window cracked; more gunfire erupted. The fugitives were using real armaments, and the Beetles rapidly switched from stun projectiles to seeker bullets. More uniformed BTL officers rushed from side streets, weapons ready, prepared to apprehend the three

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remaining escapees as they reached the sidewalk.

The people ran about pell-mell, knocking over flower kiosks, rushing for shelter inside buildings across the square. Amid the confusion Eduard could easily have snatched up another armful of flowers, but he decided not to.

Besides, it was more interesting to watch this operation.

In the previous week's incident, the anti-COM terrorists must have set explosives right across the street from their own hideout. This small group had incurred the wrath of the computer/organic matrix and brought about the recent terrible storm. Now the Bureau would finish the matter.

The three survivors hit the sidewalks with bent legs and snapped off their elastic ropes. Released of tension, the cables spun back up to the higher level, flailing like angry cobras. In unison, moving with well-practiced ease, the fugitives tore off their outer shirts, revealing different colored clothes underneath, bland street clothes. Even while dodging weapons fire, even in plain sight, they threw the tattered garments into the crowd. They each ran in separate directions.

The Beetles ran to apprehend the three before they could get away. Eduard had a prime view, watching the fugitives rush in separate directions, moving in a drunkard's walk to keep their flight from being predictable.

One of the three, a redheaded woman, spotted another key person in the crowd hidden under one of the vendor stands, who raised his hands in some kind of signal. The man was a plant in the crowd, someone there watching and spying. The redhead rushed to him and bent down.

Eduard tugged Garth's arm to get his attention, but the other young man was too astounded by the whole event. "Look at that," Garth said.

The fugitive woman and the man hiding under the kiosk clasped each other's temples, quickly locking eyes. Eduard noticed with a shock that neither of them had ID patches on the backs of their hands, just a small squarish scar. Then the redhead got up and ran in another direction, while the man quietly sauntered into one of the buildings, disappearing from view.

Eduard couldn't believe what he had just seen. "They hopscotched, the two of them! She had a contact in the crowd, and she got away." He laughed in surprise. "That woman swapped identities with him and then ran!"

Another of the fugitives ran like a bull through the flower stands, knocking over buckets that held long-stemmed roses, upending pots of marigolds. Teresa stood alone, still with the bouquet in her arms, unable to move. The fugitive grabbed her, hissed in her face so forcefully that spittle shone on her cheeks. "Hopscotch!" he said. "Now! *Swap with me!*"

Teresa looked up at the flushed man. "I . . . I can't. I'm not old enough." The man let out a snarl of despair and outrage.

Beetles ran toward them, shouting, firing their weapons into the air and making a fearful racket. The man looked around wildly again, then grabbed Teresa's arm out of desperation.

Garth's jaw dropped open, seeing Teresa in peril. He couldn't move, overwhelmed like a deer in the headlights.

But Eduard knew instantly that the fugitive meant to take her as a hostage. He didn't stop to think about himself or his danger. "Teresa!" Eduard sprang forward, bending his shoulder down. He plowed into her with enough force to rip her out of the fugitive's grip. As the man squawked in surprise and anger, Eduard bore her down to the pavement, covering Teresa with his own body. The beautiful fresh flowers flew around her in a blizzard of color, petals, and scents.

Then the Beetles targeted on the lone fugitive as he whirled, empty-handed,

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searching for another means of escape. The Beetles opened fire into his chest, a mixture of stun projectiles and deadly bullets.

Eduard rolled with Teresa, protecting her, holding her tightly. One more shot rang out, and the terrorist flew backward, scraping across the ground as blood poured from holes in his new disguise shirt. Darts poked out like bristles from his shoulders, sides, face.

The Beetles marched up to their victim, elbowing people away. They bent down, grabbing the dying man's collar and dragging him into a sitting position. "Where's your leader?" one demanded. "Who is she? Where is she?"

"She's not me," the man said weakly, then smiled in triumph with blood-flecked lips.

After crawling away, Eduard dragged Teresa to her feet, and she clung to him. Garth finally snapped out of his shock and moved to join them, shuddering.

"Come on." Eduard hustled his friends away from the scene. "We don't want to be here right now. None of us." For now, the Beetles were too intent on their victim to question the crowd, but that wouldn't divert them for long.

"I couldn't move," Garth said, his face pale, his hands trembling. "Teresa, I . . . I'm sorry. I wanted to help."

"She's all right." Eduard cut off further conversation, taking charge. "All three of us are fine. Let's move!"

He ran, remembering the clever trick the other fugitive had used to escape, and he knew this was the kind of skill he'd have to learn in order to become a Phantom one day, slipping through society and living forever. He marveled at how smoothly the fleeing redhead's plan had gone.

The three of them ducked into an office building, took a lift-tube up four levels, and hurried across a promenade. Then down a moving walkway, zigzagging through another galleria filled with stores and lights and music.

Eduard kept glancing over his shoulder, making sure they weren't being followed. "Walk slowly, casually," he said. "Don't draw any attention to yourself. We can't look like we're on the run."

They marched across a transparent tube high above the streets to a different building, then another, and finally back down again.

"But why are we running?" Garth said. "We didn't do anything."

"That man touched Teresa. They might think he swapped with her. That's how the other one escaped."

"But I'm not," Teresa said, looking down at her ID patch. "I'm still me. I don't know how —"

"Do you think someone like that would take the trouble to synch ID patches? I saw just scars on their hands." Eduard looked at her sharply, his eyes burning. "Do you want your mind peeled just so the Beetles can prove your identity? It's what they do, you know. That's what I've heard."

Garth and Teresa both shuddered, but they didn't question Eduard as he continued to lead them on a convoluted wild goose chase. They wound their way through streets that they now saw as dark and dangerous, instead of filled with wonders.

Eduard managed to lead them back to the Falling Leaves. It was only when they had reached the heavy wooden doors that Eduard realized they had not, after all, brought back the flowers Soft Stone wanted.

–7–

When Daragon looked up into Soft Stone's clear blue eyes, he saw only concern there, an intensity that frightened him. They had made no progress in the months after the COM power outage, and he was at an age where he felt like a failure. The ability to hopscotch came easily and naturally to everyone else, but Daragon seemed to be a throwback.

He sat on a sturdy chair in the small training room; the walls were painted robin's-egg blue. The old monk pushed

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her rough face closer to his, within inches, boring her gaze through his skull. He watched the sinews of her jaws tighten like pulleys. Her breath on his cheeks smelled like cinnamon.

"Look at me, child. Through my eyes, into my mind. Imagine yourself *here*. Forget your body."

Daragon tried, as he had tried for years. Nothing.

Others described it as a floating sensation, shucking ethereal chains to the body, exchanging yourself with another. He waited for the light feeling, drifting, disconnecting. He knew Soft Stone had done it, that her mind was already loose, waiting to occupy his body. *He* had to make the next move.

But he could not let go.

"I can't!" Daragon said, tears brimming on his dark eyes.

"You don't feel anything? You can't sense the tugging, your soul yearning to fly?" Soft Stone had never faced such difficulty before.

He hung his head, breaking the gaze from eyes like deep glacier ice. "I can see you. I can watch your . . . your aura, and I can see when you swap with someone else. But I can't do it myself."

She looked at him abruptly, a different set of thoughts plain on her face. "You can see me? How?"

He shrugged. "Can't everybody? It's obvious, the way you move, the way you . . . seem. Your individual persona. I don't know how to describe it."

She held up the back of her hand. "You mean my ID patch?"

"I never need to see an ID patch. I don't really understand why they're so important."

The old woman stood up, stretched her taut back and shoulders, then touched Daragon's head. "I had begun to suspect as much." Her fingers trembled. "Wait here, child. I'm not sure there's anything more I can do for you today."

Leaving him to contemplate in the training room, Soft Stone marched out the door with a swish of her sky-blue robes, intent on an experiment, a mission. The first monk she found was dour Hickory, working in the garden. He sweated under the hazy sunlight, hacking at the ground with his hoe and then leaning on the worn wooden handle to rest. He bent over a tomato plant and plucked off a fat green horn worm.

As she came up to him, Hickory held up the caterpillar, scrutinized it, then crushed its head between his fingers. "All things must fertilize the earth." He cast the dead worm onto the ground and rubbed his fingers on the front of his ocher work robe to wipe off the mess.

"Swap with me," Soft Stone said without preamble. The Splinters occasionally hopscotched with each other, when necessary, but preferred their homebodies.

Hickory blinked at her, as if somehow offended. "I hardly think this is the time or the place —"

"I'll determine that," she said sharply. "I need your body as part of my training work." She reached out to take the hoe from him. "Besides, you can work better with my fresh muscles. Yours look tired by now."

With a sigh, the other monk touched her, and they swapped without synching their ID patches. "I'll be right back." Hickory seemed very nonplused, but Soft Stone strode off. Then she returned to the training room. Now she smelled of sweat and dirt and warm sunshine. The ache in her male muscles came from exertion rather than age, and Hickory's eyes were sharper than her own.

As she came back in, Daragon looked up at her in the gaunt male monk's body, his expression remained dejected. She spoke in Hickory's gruff voice. "Soft Stone has asked me to continue your training."

"But . . . *you're* Soft Stone." Daragon gave her a puzzled frown. "Are you trying to trick me?"

"No, child," she said. It was true,

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then. He *did* have the ability, an incredibly rare skill. There was something fundamentally missing in Daragon, but also something so much more. Something never before expected. "I was just testing you."

This young man would never be able to hopscotch like the others, but his special inner vision would offset the lack. And certain people would be desperate to have access to what Daragon could do. Very desperate.

"We're through for today, child. Go out in the garden and help Hickory. I'm sure he can find more chores for you to do. I have to go talk with Chocolate."

Feeling as if she had failed in her lifelong training of her young ward, Soft Stone shuffled down the hall, head hung, to see the administrator of the Falling Leaves.

At the very least, perhaps the Splinters could use this to save the monastery.

For several nights afterward, Teresa held Daragon in the dark. He clung to her even after they had tenderly made love, sharing each other. Though he couldn't explain it to her, Daragon needed her more now than he ever had before.

Something was wrong, something would happen to him soon, and it terrified him. Soft Stone had refused to explain anything to him. She seemed just as frightened, but in a different way.

She could smell their musk, feel his soft skin against her. Shifting her arm, she pulled the blanket up to cover his shoulders. Daragon wasn't asleep, though he remained silent. She looked at him. His eyes flashed against hers in the shadows, straining, as if he was trying to exercise his mind, attempting to swap with her, just to show he could do it.

But Teresa felt nothing stir, no sense of joining with him. When she did this with Garth or Eduard, she could feel the linkage, the insubstantial bonds that told her if they just continued practicing, if they could just figure out the last little secret technique, they could hopscotch with each other.

But Daragon couldn't do it. Though he was a year older and should have been more skilled, more susceptible, he seemed crippled in some way, lacking in a perfectly normal ability.

Daragon finally squeezed his eyes shut, then buried his face in the hollow of Teresa's neck. She ran her fingers through his dark hair, squeezing him tighter.

"Chocolate says he wants to see me tomorrow," Daragon finally said. "Soft Stone will be with him. I think they're bringing in outsiders."

Teresa frowned. "You mean it's your testing? They're going to do it privately, not in the main gathering hall?"

"You know I'll never succeed in my testing. I can't! I don't have a clue how to hopscotch." He drew away from her. "This is something else. I think . . . I think I'm going to be taken away from here."

Teresa pulled him close again, comforting him because she cared for him. They had made love before, but this was more special for him, more desperate. Though he had been with them all their lives, Daragon remained something of a mystery to her. He tried and tried to be mentally intimate.

Still, Teresa could feel stirrings of maternal instinct inside her. In a sense, it was easier to give unconditional comfort to a relative stranger than to someone with whom she shared such an intimate understanding. She shushed him, told him everything would be all right, whispered meaningless but endearing phrases in his ear. Teresa held him, but Daragon did not sleep all night, and neither did she.

Anxious, Daragon waited in the administrator's office. Soft Stone stood there beside him, offering silent strength and comfort. Chocolate paced

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behind his carved desk, impatient.

Daragon didn't know what to expect, what they were waiting for. Not knowing made the experience worse. He tried to hold his head up, to be brave.

"Don't worry, child," Soft Stone said. "You'll do fine." The lie was plain in her voice.

Before Daragon could get up the nerve to inquire, he heard footsteps coming down the hall, the whicker of sandals and robes, the staccato drumbeat of bootheels. One of the lesser monks, intimidated and flushed, led two Beetles into Chocolate's office, an inspector and a sergeant. Both wore neat uniforms with different insignia; their demeanor denoted confidence and efficiency.

"Is this an attempted bribe?" the Inspector asked directly, wasting no time.

Chocolate blew air from between his lips, genuinely shocked at the suggestion. Soft Stone stepped up beside Daragon and met the Inspector's attention. She placed her hand on the young man's shoulder. "No, sirs. But we have something to show you, something you may find interesting. Something we believe the bureau will value highly."

Daragon looked at the uniformed men. The BTL used a broad spectrum of abilities for locating and tracking people as they moved through a society where physical appearance and identity could be made meaningless. Some of the Beetles were slightly telepathic; some were gifted database surfers with a particular rapport with COM; some were just intuitive detectives. Daragon knew he had no such talent.

But as Soft Stone explained the problem to the two bureau representatives, their interest picked up. They looked upon Daragon's failure as a different kind of potential.

"Test him if you like," Soft Stone said. "I'm confident he will prove himself in every way I have described."

"Yes." Chocolate bustled forward, joining Soft Stone and Daragon. "While this young man is physically incapable of swapping minds, his mental abilities have instead turned inward. He's not a throwback—he's . . . different."

"That remains to be seen," the Inspector said as the sergeant withdrew several pieces of scanning equipment.

Daragon looked in alarm at Soft Stone, then at the scanners, the electrodes. He wished Eduard could be here. The monk squeezed his shoulder again. "Just relax." Her voice sounded like a cold wind. "You'll do fine."

Barely managing to restrain their excitement, the Beetles ushered Daragon away. They vowed to take care of him, to give him a respected position and important work in the bureau. He had reached the age of adulthood, but remained young enough to be malleable, to be trained in their ways. The BTL had a rigorous curriculum already designed for talented people like him.

Soft Stone hugged Daragon, trying to crush away his fear and uncertainty. She mouthed the words, repeating that the Bureau did vital work in society, that with his special skill he could be a valuable asset. The BTL would treat him right. No other person from the Falling Leaves could hope for such a remarkable opportunity; no one else had ever passed the tests.

Beside him, the Beetles promised similar things. The main difference was that the uniformed men seemed to *believe* what they said.

As the others in the monastery gathered in shock, Daragon looked around himself, resigned. He feared to be separated from his friends. Garth, Teresa, and Eduard stood together in the hall, unable to believe what they were seeing. Teresa stared at the monks, at Soft Stone; her eyes sought an explanation, but no one would meet her gaze. . . .

As the young man was led away, taken out of the protective monastery, Soft Stone watched sadly. She had become accustomed to watching her children

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leave, one by one, out to a wider life as they grew old enough.

But the loss of Daragon was quite different. And she herself was responsible for it.

—8—

Under the pretext of searching for advice and guidance, Teresa went to see Soft Stone in her quarters. The woman had not emerged for days, hiding and withdrawn since the Beetles had taken Daragon away.

Teresa rapped a second time on the door frame, but after hearing no response, she drew the heavy curtain aside and entered unbidden. Two candles lit the small room, shedding a little warm light. Teresa could smell the heated beeswax mingled with a stick of smoldering incense.

Soft Stone was deep in meditation, hunched over her cot. She didn't flinch. "I did not ask to be interrupted."

"I'll just meditate with you, then." She hunkered down in front of the old monk, waited for a few painfully long moments, then finally spoke up. "I miss Daragon."

Soft Stone reacted as if Teresa had thrust a dagger through her heart. "I surrendered one of my own children to the Bureau. What is he ever going to do with them?"

Teresa heard the horror in the woman's voice. "Probably the best he can, don't you think? Daragon always tried very hard."

"They'll make him one of their own." Soft Stone's entire body shuddered. Her once clear blue eyes now looked cloudy and old. "He was our ransom, to save the Falling Leaves. Selling him was the only thing we could do. I couldn't think of any other way."

In confusion, Teresa reached out to touch the female monk's wrist, below her ID patch. "What do you mean?"

"The BTL wanted to oust us from our monastery building so they could have a second headquarters here on the mainland. Chocolate tried everything, but we were going to be evicted. The other Bureaus sided with the BTL, and the Splinters had no way to challenge them." She looked Teresa directly in the eye. "Until I discovered what Daragon could do—and how much the BTL was likely to want it. Finally, they made a deal with us."

Teresa couldn't believe what she was hearing. One of the candles flickered, as if a ghost had just walked by. Two monks sauntered past the curtain, sandals scratching along the hallway, but she concentrated on Soft Stone. "You traded Daragon to insure the safety of the monastery?"

"We now have our title, free and clear. With no further claim by the Bureau of Tracing and Locations. Daragon was worth more to them than our entire building." Unable to control herself any longer, Soft Stone's body was wracked with sobs.

Teresa tried to comprehend the scenario. "But why would the Beetles want Daragon so badly?" She had loved the young man, felt a warmth when she thought of him, but why had the Bureau seen him as so special, so valuable?

"Because he can *see* people, child. Daragon can identify anyone he knows with just a glance, even without consulting an ID patch. He can't swap, but he can look where he cannot go."

Teresa frowned, shifting to a more comfortable position on the cold floor beside her mentor. Soft Stone continued, her voice forlorn, "The Beetles look at the world through frosted glass, much the way they see COM as a sweatshop of souls, rather than a congregation of lives, Heaven come down to Earth." She shook her head. Bristles of grayish hair had begun to poke out of her smooth scalp.

"And they see that as an advantage?" Teresa said. "I think it would be terrible never to swap with anyone, to experience only your own life and nobody else's. I'm so sorry for Daragon."

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"Not just that, child," the monk said. "It implies to me that Daragon's soul is anchored, unable to separate from his body. What if that means he is unable to move on in the Wheel of Life? Did I fail him?"

Teresa went away from the old teacher, unsettled at having seen the tracks of tears on Soft Stone's rugged face.

Two days later Soft Stone emerged, pale and stoic, and went to see Chocolate again, this time determined. She had searched her mind and soul, and come to a decision. The Splinters would not like it, but they would accept it. They had no choice.

Shaken to her core by the loss of Daragon, Soft Stone decided she had reached the time for her own passage. The community of other presences inside COM beckoned to her.

"I can hear their whispers behind the glimmering phosphors on the interactive screens," she said, repeating her well-rehearsed words, which she had written down as a poem. "I can see snatches of nirvana hiding within the vast thinking sea. I want to be part of it, join those myriad others. I will drink the wine of knowledge, bathe in the milk of unending experience."

Behind his desk, Chocolate grew pale. He drummed his pudgy fingers on a desktop now clear of legal documents or demands of eminent domain from the Bureau of Tracing and Locations. The monastery belonged to them now.

But the Falling Leaves was also without Daragon, because she had set him up as a sacrificial lamb. Soft Stone didn't deserve to remain here either.

"I cannot refuse your request," Chocolate said, "though it saddens me."

"We should view this as a time of celebration," she said, not believing it for a moment. "You of all people must treat it that way. Don't you believe in what COM offers to us all?"

"My question is, is your work here done?"

"It will never be done," she admitted. "But I am done with the doing."

Soft Stone had spent years isolated inside the monastery, hiding from wider responsibilities. Even as a young woman, back in the prime of her life, she'd always had second thoughts about closing herself away from the outside world. It seemed like shirking her responsibilities of what she could have accomplished out there. She could have been a strong cobblestone in society.

But instead she had retreated into the Falling Leaves, taken a new name. Soft Stone rationalized her cowardice by thinking of herself as a seed, helping special children to blossom, bright new souls who would grow and bear far better fruit than she could ever do herself.

Soft Stone had borne no children, nor fathered any in a male body. Seeing the discarded children like Teresa and Daragon, she couldn't understand how true biological parents could so easily abandon their children.

Instead, in the Falling Leaves, Soft Stone had adopted Garth and Eduard, Teresa and Kanshah and Daragon as her own. They, and their predecessors here, were her emissaries to the world, her great accomplishments in life.

Thus, the loss of Daragon was a tremendous blow to her.

Even before she had sequestered herself for days of reflection, meditation, and (she admitted it) wallowing in misery, Soft Stone had communed in the great Falling Leaves library. At times when she was alone, she liked to feel the computer/organic matrix around her, listening to all the data, all the stories, all the human spirits speaking to her. COM was a great unexplored world that called to her, but she had resisted the temptation, focusing on this world and her obligations.

Until now. Soft Stone was finished with all she could do . . . at least all she could do from here.

"I intend to upload myself tomorrow

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at noon," she said with finality, and turned to leave the administrator's office.

Chocolate didn't know what to say to her, and so he said nothing.

They gathered in the library and database room, Splinter monks as well as their charges of all ages. Some sniffled and looked sad, others whispered, others blinked with wonder and anticipation.

Garth didn't know what to feel. After the recent loss of Daragon, and the departure of Kanshah months before that, he had drawn even closer to Teresa and Eduard. Too many things were changing. Within a year, he and his two closest friends would have to leave the monastery themselves, becoming adults.

Soft Stone would not be there to ease them into their new life. She was going to vanish, willingly upload her soul into the vast computer matrix.

Since humans could hopscotch from body to body at will, and because COM was organic and multi-layered, it was possible through hardware and uplink cables to hopscotch into the network itself. Soft Stone would transfer her consciousness out of her body into the labyrinth of data, committing virtual suicide. The Splinters believed the soul remained there by choice, a part of a greater cosmic mind. No one ever returned from the matrix.

"We have already proven that our *selves* are detachable," Soft Stone had said during a teaching session, more than a year earlier. "Imagine swimming in the ocean of humanity's knowledge, watching every life, every transaction."

For the ceremony Chocolate wore his finest robes, welcoming everyone. Incense burned, smelling of pine needles and cloves—Soft Stone's favorite scent. Candles guttered next to the glowing data terminals, adding a warm light like starshine.

Teresa tugged at Garth's arm, pulling him and Eduard forward so they could stand closer to the front of the crowd. Tears brimmed in her eyes.

"It's not dying," Soft Stone had said. "It is living on a higher level. A much higher level."

She emerged from the rear entrance of the library, passing between some of her favorite paintings and sculptures. Garth remembered how Soft Stone had stood with him, looking over his shoulder as he studied the painters' techniques, the sculptors' details, teaching him from the masterpiece objects as easily as other students learned from COM databases.

Barefoot, the lean woman walked with grace and confidence, shoulders square, chin high. Her sky-blue robes were adorned with brass bangles that tinkled as she moved. Her skin was flushed, scrubbed clean; her newly shaved scalp glistened as if she had waxed it.

Soft Stone smiled, her blue eyes bright and clear again. As she glided forward, a hush fell on the gathered crowd. The beatific smile on Chocolate's chubby face flickered for just an instant of uncertainty.

She walked toward the main COM interlinks in the center of the library. Soft Stone reached out to brush the hands of her students, giving them a benediction, saying farewell. The younger children did not understand, some were crying or giggling.

The old monk paused in front of Teresa, Garth, and Eduard, and suddenly her expression crumpled. Her shoulders sagged. She swallowed hard as the three friends reached out to touch her, then enfold her in a deep hug.

"Trust me always," Soft Stone said in a hoarse whisper. "I'll try to watch over you. Remember, COM has eyes everywhere, and I'll be part of it."

When she stepped up to the library terminals, she faced the others. Warmly, she kissed Chocolate on both cheeks. Then he backed away, leaving the fe-

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male monk alone with the computer network.

The glowtiles dimmed in the library chamber, and the candles flickered more brightly, burning like tiny attendant souls. She reached out with callused hands to touch the computer inputs.

All other monitors in the library chamber flared to life, glowing. Three-dimensional interactive portals painted an artificial sky with fluffy white clouds on the ceiling of the library.

Soft Stone closed her eyes and drew a deep breath.

Living lights swirled like comets along the walls, painting a forest, a river, birds and flowers. Chimes came unseen from the virtual distance, a resonant humming that tingled in Garth's bones. The spiritual ceremony was like an old VR multi-user experience room; he wondered how much was real, how much miraculous . . . and how much was staged.

Then the scenes changed, the images cracked, replaced by a different construct. Soft Stone's fingers tapped the edges of the milky interactive screens, trembling, but she added no direct input that Garth could see. This magnificent presentation flowed directly from COM, images broadcast as part of the computer experience.

Now the Falling Leaves library transformed into a great vault, an immense cathedral far larger than the monastery building, with stained-glass windows and a thousand different passages. A symbolic representation of the labyrinth of the computer/organic matrix. Soft Stone's mind could spend eternity in here, wandering among all knowledge, all recorded history, even other lives.

Garth stood with his mouth open, staring. The behind-the-mind music was like crystal, the light was like gemstones.

As Soft Stone's brow wrinkled with concentration, she mentally connected herself to COM and prepared to upload her soul. The others in the room, surrounded by the illusion, held their breath.

Glowing images appeared in the air around her, luminous beings that swirled like angels. Flashing entities from the network came to greet her. She raised her hands, then her eyes. The escort presences engulfed her like a safe cocoon, then they took her away into the sparkling labyrinth. The old monk left her body behind forever. A shadow of Soft Stone floated with them, younger and stronger, more vibrant. All the spirits vanished into the fascinating, unexplored stained-glass passageways.

Then all the images faded, and the library came into focus around them again. The old woman's body slumped to the library floor, an empty husk.

Garth stood cold and alone in the candle-lit room, surrounded by breathless people. Chocolate moved to kneel beside Soft Stone's body, cradling her bald head in his hands. Excited conversation erupted in the library.

Eduard leaned over to Garth. "Do you think those images were just computer constructs? Was that a show Soft Stone prepared for us?"

Teresa frowned at him. "Oh, Eduard, don't be so cynical."

Garth stood awed by the beauty of it. "I don't care what it was." He had found it more inspiring than anything he could remember. "I just hope that someday *I* can make something as beautiful, something as moving."

—9—

Over the next few weeks, once the Beetles withdrew their interest in occupying the Falling Leaves monastery, the Bureau operatives plunged with greater enthusiasm into the search for anti-COM terrorists.

Squads raided another hideout, and most of the remaining technophobes were killed or captured. The ringleader and another deputy managed to escape

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again, but the chain of violence was effectively quashed.

Teresa wondered if perhaps the benevolent intercession of Soft Stone's new spirit in the computer/organic matrix had helped to make the peace. COM offered no further power outages or retaliatory weather disturbances. The city returned to normal.

But the monastery itself was forever changed. Teresa wandered the lonely halls, trying to distract herself with her studies, attempting to find other subjects that would interest her. Without Soft Stone, without Daragon, even without gaunt young Kanshah, the big old building no longer seemed like home.

The dusty-smelling corridors, the brick walls, the window alcoves and meditation rooms felt empty now. Before, she'd been engrossed in what Soft Stone bemusedly called her Big Questions, wrestling with esoteric spiritual concepts. But now Teresa despaired of ever finding real answers. She had wandered into a deep philosophical jungle, and her only guide had gone away.

In the nights she clung to Eduard or Garth, or both. She held onto her greatest points of stability, loving them, trying to feel desperately close. The recent changes—Kanshah, Daragon, Soft Stone—were poignant reminders of how soon she, too, would have to go away from the Falling Leaves.

Since they were about the same age, at least she, Garth, and Eduard would be together, to face the world as a trio. They might be together . . . they *had to be* together. If only they could all three learn how to hopscotch at the same time. . . .

Teresa lay next to them now, sandwiched between Garth and Eduard on pushed-together sleeping pallets. Their naked skin was warm on hers, their scent muskier and much more masculine. What would it be like to inhabit their bodies, to move their muscles, experience physical and sexual responses as a man instead of a woman? She loved them both, and once they were able to swap themselves, male/female—it would make no difference.

They had all experienced sexual intimacy before, sharing each other in the way the Splinters taught. Bodily explorations had actually been encouraged by Soft Stone, so long as they used the proper precautions and maintained relative privacy to keep from confusing or frightening the younger children. As preparation for learning to hopscotch, Teresa needed to explore other bodies besides her own, by touching, sensing, feeling—trying to understand what other human beings enjoyed, and why.

She also worked hard to become totally familiar with her own biology, to know her nerves, her systems. Only with this awareness could she understand her individuality, and also the things she shared in common with all other people.

Lying awake, Teresa could sense the potential in herself, feel her thoughts floating free, her spirit soaring, ready to go. But so far she had not been able to exchange herself, to hand her soul to another person and take theirs into her home-body. She had tried and tried, but she had not succeeded.

Lately, each failure intimidated her, as well as Garth and Eduard. The three of them had seen Daragon's fate when he'd proven incapable of hopscotching. Teresa didn't dare let it happen to them; they needed each other.

In the night, she reached out and pulled them both close.

Without Soft Stone, the monks who took over the mental instruction of the three oldest teenagers were clumsy and unimaginative. Hickory was impatient and sharp-tongued, Chocolate was too busy, and the other monks had their own groups of younger children to attend.

The new teachers did not comprehend the best ways to communicate difficult concepts to Teresa. Soft Stone had

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been special.

Alone, Teresa found the most peace and concentration out in the garden. For months she tended the plants, plucking off dry leaves, removing weeds, adding mulch or loosening soil around the roots. She worked there in her free time even when she wasn't assigned the duties; Hickory seemed perfectly glad to let her have her way.

Teresa stared down at the sun-warmed vegetables, but her mind drifted far away . . . as if she could let it detach itself and travel elsewhere, hop into another body and exchange places. She could be someone else, share a different physique for a limited time.

If only she could teach herself how to hopscotch, then she could show Garth and Eduard. The three of them had a rapport already so close it seemed borderline telepathic. Never with anyone else had she achieved such a thorough sharing of thoughts and moods.

Of the three, Teresa was best at introspection, at working with the chains holding her mind to her body. She knew she could figure it out.

She had to.

Teresa bent over, felt the warm sun on her lower back, the sweat on her shoulderblades, and tried to imagine what it would be like if she could work in another, stronger body. Perhaps she would become an athlete in someone more lithe, or explore tiny confined spaces in underground maintenance conduits in a smaller, compact body. External appearances wouldn't matter—male or female, old or young, large or small, weak or strong—because it would still be *her* inside.

She parted velvety, pungent-smelling leaves of the tomato plants, searching for ripe, scarlet spheres. Teresa plucked one, large and slightly soft, and placed it in the basket at her side. She let her mind wander, her thoughts travel free—just the way Soft Stone had encouraged.

She picked another tomato, tugging, feeling the stem snap free, parting from the parent plant along an invisible but natural line. The ripe tomato came free—and she felt a similar *snap* in her own mind, as if something inside her head was also ready, prepared to separate.

Her vision reeled, and she blinked several times, trying to comprehend what had just happened.

She had dropped the tomato on the dirt and now picked it up again. The stem was broken on top, severed cleanly. Teresa let her mind open again, her thoughts flow, and wander . . . and *separate*.

No one else was with her in the garden, so she couldn't test her new idea, couldn't attempt to hopscotch. But she felt the change, the realization. She knew she could swap her mind, and she understood the implications.

And she knew how to communicate with Garth and Eduard. She understood how to explain what she had done in a way that her two friends would comprehend, deep in their hearts. With them, she could speak a personal language that none of the monks could fathom.

Leaving the rest of the unpicked tomatoes behind, Teresa ran back inside the confines of the monastery.

"Follow me," she said urgently. "I've got to show you something. It might take a while, but I know you'll get it."

Practically dragging them by the arms, she took Eduard and Garth down into the lower levels of the Falling Leaves, heading for a place she knew they could be left alone, alone for as many hours as it might take.

They went into the small, forgotten storeroom where a long time ago Garth had painted his mural, now masked by a thick coat of tan paint.

Teresa hunkered down; Garth and Eduard gathered close to her. She had brought a portable glowtile, so they wouldn't need to tend a candle. This exercise would require all of their concen-

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tration. The soft light shone on the old brick walls, illuminating ghosts of Garth's painstakingly drawn scene of imaginary nostalgia, barely visible behind the beige mask.

The floorboards creaked above, and Teresa knew the monks would be going about their rounds, checking on their trainees. With Soft Stone gone, no one watched Garth, Teresa, or Eduard very closely anymore, but someone would eventually notice their absence.

Teresa hoped they would have enough time together.

"Oh, if we can all learn this at the same time," she said, "then we can go out together, support each other in the city, help each other make the transition."

"We won't be all alone like Kanshah," Garth said.

"Or Daragon," Eduard said, though the BTL had taken Daragon so firmly under their wing that the young man wouldn't need to worry about anything . . . except the freedom to do what he wanted to do.

"I think I understand how to hopscotch," Teresa said. "I was thinking, concentrating. Then something clicked."

"Soft Stone always said you were the deep one," Garth said.

"Yes, and now I have to show both of you." She closed her eyes and reached out with both hands, one touching square-shouldered, blond Garth, the other touching wiry, dark-haired Eduard.

"This is going to be strange, at first, I think." Her voice was husky with fear and uncertainty. "Here, let me teach you."

Garth stood naked in Eduard's body, staring at himself, at his two friends who appeared the same to him, but different behind their eyes. "Look at that."

The three of them had spent their lives leaning on each other, without parents and without last names. They had learned to depend on their mutual skills. Garth loved Teresa and Eduard wholeheartedly and equally.

And now this was so much more. Now they were thrust together in an entirely different way. They *were* each other.

Garth flexed Eduard's wiry arms, blinked his eyes. "This feels weird, familiar but . . . not. I'm stronger in some ways, smaller in others. I—"

Eduard interrupted him, standing inside Teresa's shape. He kept touching his skin, his arms, running his palms over his new breasts, tweaking his nipples. "Wait until you try this, Garth. She's got nerve clusters all over her body." He stroked the patch of hair between his legs, startling himself. "It feels tingly in places that never did anything for me. And empty in others."

Teresa wore Garth's home-body like a baggy uniform. "It's like I'm in a big suit of armor." She drew deep breaths, touched her rough face, fondled her new penis, which seemed to have a mind of its own and defied conscious muscle control. "And this—it's like an appendage, but I can't do anything with it."

"Yes, you can," Eduard said. "You'll figure it out."

"But it doesn't move like any of my other body parts. I can't control the reactions—oh!"

Garth and Eduard both laughed.

Down in the small storeroom lit only by a portable light tile, they began to explore each other in new ways. The boundaries between friendship and sexual love and physical differences blurred, then vanished. Their shadows merged on the walls, becoming indistinguishable, three people, three different bodies.

"Oh, I never thought it'd be this strange," Teresa said, listening to the deeper voice in her head, touching the male muscles, the fine curly hair on her chest.

"So many things are the same, funda-

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mentally equal, whether I'm in my own body, or Eduard's, or Teresa's," Garth said. "But every one is different, too."

"Not so different," Eduard said. "It's what you do with the body that matters." He looked over at Garth through Teresa's eyes, while Teresa looked down at her own hands, at Garth's hands.

"Then let's . . . *do* something," Teresa said, her voice small even in the large, blond body.

They'd made love before, but not like this. It was a strange and wondrous sacrament, the three of them *being* in their friends' bodies, looking at each other through new eyes.

Eduard made love to Garth, who was in Teresa's home-body, while Teresa herself stood by, wearing the blond-haired male form she had known as Garth all her life. Now, suddenly, they were inexperienced again, embarrassingly so. But they experimented without shame.

They swapped again. And again.

Teresa coached Garth and Eduard, instructing them both in techniques and responses she had learned through her own explorations of her own body. She helped, she touched, she participated.

Eduard had experienced sex with Teresa in previous years; this time the person inside was completely different, though the body remained the same. His reactions and responses in a female shape were different from what he had anticipated.

Garth was uncertain, but curious, trying to cope with a radically altered perspective. He was in a woman's body now, making love to a man, and he had to be aroused by a man, though he had never thought in such a way before. The mind had to adjust to a new reality, while the body's hormones and natural responses remained the same, assisting.

This was Eduard, his friend, his comrade . . . but when Teresa (in what had been his own body) helped him to touch the ultra-sensitive areas on his breasts, his skin, his clitoris—a vastly new sensation—he began to understand what he had to do. The sensations rapidly became overwhelming. The physical body knew what to do, and did it well. . . .

Sweating and drained but tingling all over, Garth (in Teresa's body) came forward, touching what had once been his own buttocks, the backs of his thighs.

"Here, Teresa, let me show you something. I know you'll like this."

It turned out that the monks had no idea where to find them, and the three had hours to talk with each other, touch each other, swap again and again. They described the way their own bodies worked, demonstrating to their friends.

The lovemaking was satisfying, and exotic, and exhausting—but in the end they realized that for such deep friends, the very act of hopscotching into each other's bodies was vastly more intimate than sex. . . .

EPILOGUE

Far from the Falling Leaves monastery now, turned loose to explore the real world beyond the walls, Eduard, Garth, and Teresa drew strength from each other

The three of them looked at Club Masquerade, intimidated and anxious. They had never been inside before, and now they tried to strengthen their resolve. "Look at that," Garth said.

"Isn't this place great? Let's go inside," Eduard said without taking a step forward. "I want to see it after all this time."

"We've got the freedom to do what we want now," Teresa said, somewhat downcast.

As children, then as teenagers, they had thought about this place. Club Masquerade was so exotic, so alien, a place unlike anything they had ever experienced. The monks always calmly encouraged them to discover new intellectual things, but very little true life

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experience. It was the Splinters' blind spot.

After having learned how to hopscotch and proving their skills to Chocolate and the other Splinters, the three had left the Falling Leaves together. With a few credits in their pockets and new opportunities before them, they made their way in the city. Garth, Teresa, and Eduard were on their own, yet together and strong.

The frenetic club atmosphere seemed so exciting that it had to be somehow forbidden. A swirl of eager customers flowed in and out, some furtive and nervous, others totally open. And the people who went in were not necessarily the same people who emerged again.

The monks had not talked about the Club, did not see fit to encourage wild stories or fascination over such businesses. Rumors among the other Splinter children portrayed Club Masquerade as a haze of body swapping, a confusing blur of shifting identities, a human exchange.

Teresa looked behind her, and the old brick brewery seemed far away. The "real world" also tugged on her now. Directly before them, the edifice of Club Masquerade fascinated and lured her.

Where did all those doors go? Why so many separate entrance arches? Each one passed into the main club, but different paths led through different experiences. She and Eduard and Garth could find out for themselves, as adults. As customers.

"Which door should we try?" Eduard asked. "I hear they're all different."

"I think Teresa should choose," Garth said.

She looked at both of them, tossed her auburn hair over her shoulder, and took a deep breath, steeling herself. She marched forward, across the numbered squares on the sidewalk, which illuminated under each footstep. Teresa passed under one of the many possible archways. "Come on."

With Eduard and Garth following her, Teresa entered Club Masquerade.

She stepped onto a floor strewn with dried redwood needles and tiny fir cones. The walls were made of massive knobbed trunks of sequoias with warty bark that oozed sweet-smelling pitch. The trees reached as high overhead as the tallest skyscrapers Teresa had ever seen—until she realized that the trunks vanished into a ceiling that was the holographic equivalent of a matte painting, projecting the illusion of vast height in a normal-sized room.

Teresa drew a deep breath, while Garth stood with his arms outstretched, his head craned upward, his mouth grinning. "Look at this!" he said. "Look at this!"

Rough wooden benches were scattered around the room, aromatic with a sour-spicy smell of fresh-hewn redwood. High above, in the imaginary upper levels of the conifers, rafts of cool mist clung to the branches.

"Oh, and smell the air," Teresa said, discarding her expectations of a hedonistic chamber of pleasure. She hadn't imagined this at all.

"I told you it would be amazing," Eduard said, already snooping around. He found a doorway in the side of one of the massive sequoia trunks. "Look in here—it's a medieval banquet hall!"

Other rooms offered equivalent wonders, but Eduard egged on his two friends, wanting to get to the central room. Past the outer environment lounges, the three of them finally stepped into the huge main hall, the heart of Club Masquerade.

The sunken floor was surrounded by lights, girdled by a neon bar. Seats and floating tables appeared in convenient spots of light and shadow, depending on whether customers wanted privacy or spectacle. About half of them were occupied.

The lights and decor, sounds and smells bombarded them, perfumed steam, colored incense, spraying foun-

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tains, accompanied by music vibrations and the drone of conversation. The floor was packed with dancing bodies, swaying people who touched and swapped and flitted from form to form, male to female, young to old, average to beautiful, and back again.

"Hey, doesn't this sum up . . . everything you imagined the rest of the world would be?" Eduard said, breathless.

"Yes, but this isn't going to stop me from exploring, and experiencing, and learning," Garth said. "What an inspiration!"

They climbed to a midlevel table and sat down, already eager to find a new place where they could fit in. Since they had lost two friends and their mentor, the Falling Leaves had already stopped feeling like home. Garth, Teresa, and Eduard had been mentally weaned from the monastery long before they actually set foot outside the doors. The Splinters had arranged low-level outside jobs for each of them to use as a starting place, and also provided a small stipend for the first year. But now they were independent.

Club Masquerade was the first place they had gone, where they could sever their ties from the monastery, Soft Stone, and their past.

Teresa looked at the numerous patrons, overwhelmed and intimidated by the pressing responsibility of establishing herself from scratch. Here, even with the comfort of Eduard and Garth, she felt herself to be at the heart of a cyclone, a central calm, with vast energies ready to tear them apart.

People departing from the Falling Leaves went out on their own, losing contact with their fellow students, taking care of themselves. They sought to fulfill their destiny as special new souls out in the world. Daragon was already lost to them, swallowed up by the bureaucracy in the BTL. And no one had ever heard from Kanshah.

But the three of them were a team—they had all learned to hopscotch at the same time, they had left the monastery together. Still, she was afraid of losing them.

So Teresa decided to do something to keep them together. "Let's make this our special place. Club Masquerade."

Both men looked at her, curious. They could see the concern on her face; Eduard and Garth knew Teresa well enough to sense her worries and the root causes.

"No matter what happens," she continued, "wherever we go or whatever we decide to do with ourselves, let's promise to meet here on a regular basis. We can do that, don't you think?"

"What's today?" Eduard asked. "The first Tuesday of the month? No problem."

"Sounds easy enough to me," Garth said, alarmed at the suggestion that they wouldn't be together. He had blithely ignored the possibility until that moment, but Teresa was right.

"I'll make a note on my calendar," Eduard said dryly. "But I think we'll be seeing enough of each other anyway."

"Oh, but things are different now," Teresa said. "No guarantees."

Still uncertain, Garth finally expressed himself by reaching out to clasp both of their hands, squeezing tightly.

The music continued to throb. They ordered drinks, sampled new concoctions, tasted flavored stim-sticks. Sometimes they engaged in vigorous conversations, but for long spaces they just looked at each other across the floating table.

Eduard, Garth, and Teresa remained together in the club for hours, relishing each other's company, until all three of them knew it was time to go.

Then, with the whole world awaiting them, they went out to embark on a great adventure—the rest of their lives.■

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Silicon-Based Biology: The Road to the Virtual Cell

M. Todd Washington, Ph.D.

No, it's not the "smart rocks" of science fiction, but another kind of "silicon life" is taking on an increasing importance.

Computer simulations are commonplace in the physical sciences. In astronomy and cosmology, for instance, one finds simulations of planetary formation as well as the large-scale structure of the Universe. In meteorology and earth science, one finds simulations of hurricane tracks as well as global climate changes in response to rising CO_2 levels.

Although simulations in the biological sciences are not terribly common, their use has been increasing in recent years—and none too soon. The Human Genome Project—while providing a complete inventory of the molecular foundations of life—has completely inundated us with tens of thousands of new biological molecules[1]. Organizing and analyzing data on this scale is one of the great challenges facing scientists today. Fortunately, a promising discipline—cleverly called *in silico* biology—is now emerging to help address this problem. *In silico* biology involves the use of computers to create detailed simulations of complex biological systems at the molecular level.

Perhaps no goal of *in silico* biology is more ambitious than the construction of the "virtual cell." Though now merely a possibility, an accurate computer simulation of an entire cell would be an enormous benefit in both the short term and long term. In the short term, the virtual cell could be used to design drugs and therapies to better treat diseases[2]. The simulations could be used to test various treatments to see which ones worked best and to warn about potential side effects resulting from each approach.

In the long term, the virtual cell could be used to improve the design of biological systems and even create entirely new ones. Science fiction is filled with fine examples of redesigned organisms—from engineered microbes able to help with terraforming or bioremediation projects to engineered plants and animals able to thrive in hostile, alien en-

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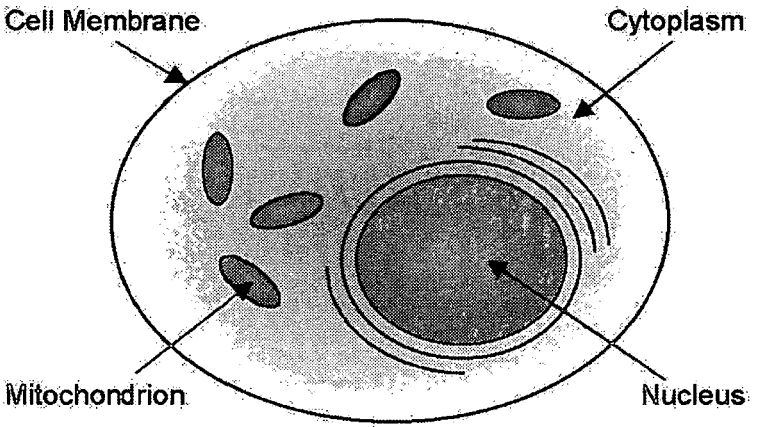

Figure 1

vironments. Again, the simulations could be used to test various modifications to see which ones worked best.

Before getting too carried away, I must temper this optimism with a healthy dose of realism. We are still a long way from constructing the virtual cell, and the road ahead is long and difficult. Nevertheless, several top scientists are finally talking about it; a few are even doing something about it. The first steps on this road have already been taken. However, before examining these steps, we need to discuss briefly how a real cell works.

1. The Actual Cell

It is virtually impossible in an entire article this size, let alone a few paragraphs, to describe how a cell works. Nevertheless, I shall attempt the impossible here—to provide an overview needed to appreciate the challenges facing researchers constructing the virtual cell. I urge the interested reader to consult any undergraduate-level biology textbook for more information on the topics to follow[3].

Cell Structure. Cells are comprised of numerous smaller structures and compartments (see Figure 1). Surrounding the cell and forming its outer boundary is the cell membrane. Many channels and pumps span the membrane and transport only certain materials into or out of the cell.

The cytoplasm—the interior space of the cell—is a thick soup, where many of the cell's biochemical reactions occur. Within the cytoplasm are specialized compartments, separated from the rest of the cell by their own membranes. The mitochondria, for instance, are specialized compartments in which the biochemical reactions needed to generate energy occur. The nucleus is a specialized compartment that houses the genes and the extensive protein machinery needed to maintain them (see below for descriptions of genes and proteins).

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Metabolites. Cells are a hotbed of chemical activity. Through thousands of chemical reactions, cells take in chemical substances from their environment, break these substances down into their basic building blocks, and use these building blocks to manufacture the materials that they require. This complex web of chemical reactions is called metabolism, and the seemingly countless chemical compounds participating in these reactions are called metabolites—the first of three types of molecules constituting cells.

Cells break down and manufacture substances using biochemical pathways—chemical disassembly and assembly lines. Suppose, for instance, that a cell needs a specific metabolite—compound C—and it already has a related metabolite—compound A. The cell could manufacture compound C using the following two-step biochemical pathway:

A —> B —> C

In the first step, compound A is chemically modified to form compound B. In the second step, compound B is chemically modified to form desired compound C.

Proteins. If biochemical pathways are disassembly and assembly lines, then enzymes are the workers and machines on the factory floor that operate each step of these lines. Each chemical reaction in the cell requires a specific enzyme catalyst. Thus, two enzymes are required to carry out the biochemical pathway described above: one catalyzes the conversion of A to B and the other catalyzes the conversion of B to C.

Enzymes belong to a class of cellular components called proteins—the second type of molecules constituting cells. Proteins are the epitome of nanotechnology[4]. Every cell contains thousands of distinct protein machines, each with a different task to perform. In addition to catalyzing chemical reactions, proteins can act as switches turning on or off crucial cellular functions. Proteins themselves can be switched on or off, and only when a protein is turned on does it perform its assigned task.

Genes. Genes are the third type of molecules constituting cells. Simply put, genes are step-by-step recipes, written in the DNA code, for making proteins, and each gene encodes one protein[1]. Like proteins, genes can be switched on or off, and only when a gene is turned on does it actively produce its encoded protein. Recent estimates place the total number of genes in each human cell at 40,000.

Regulation. The overall purpose of all this molecular activity is to allow the cell to divide and specialize. Cell division is needed for the growth and maintenance of the organism, while cell specialization is needed for the generation of specialized tissues—muscles, skin, nerves, blood, and so on. All this is made possible by several levels of regulation.

Feedback loops—the first level of regulation—act to stabilize the conditions in a cell. Consider the two-step pathway described above. If compound C is in short supply, a feedback loop will switch on the two enzymes that catalyze the steps in this biochemical pathway as well as the genes that produce these enzymes. As a result, more of compound C will be made. On the other hand, if compound C is in abundant supply, a feedback loop will switch off these enzymes and genes, and no more of substance C will be made.

Signaling cascades—the second level of regulation—act to control cellular conditions over long distances, such as those between different cellular compartments or between the exterior and the interior of the cell. In a signaling cascade, a series of protein switches relay information from one location in the cell to another. The cell's response to growth hormone is a classic example of this kind of regulation. Specialized receptors—made of proteins—span the cell membrane and monitor the cell's

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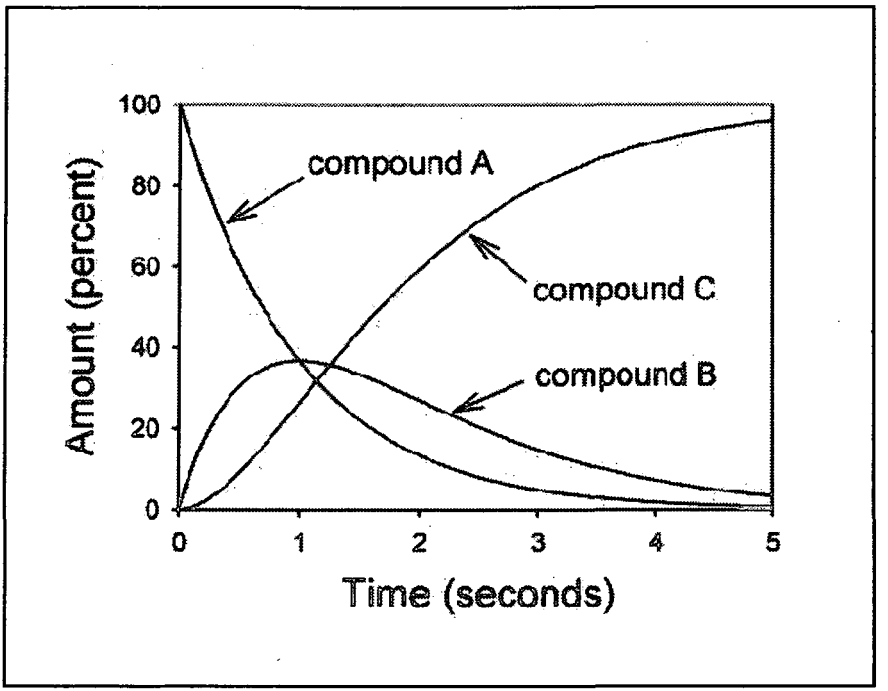

external environment for various chemicals. When a chemical signal (growth hormone) is detected, it triggers a signaling cascade inside the cell, which ultimately turns on a set of genes and proteins that brings about the programmed response—cell growth and division.

2. Biological Simulations

From the above discussion, one can appreciate the complexity involved in creating a computer simulation of a cell. Such a simulation must take into account all of the molecules constituting the cell, the chemical reaction in which these molecules participate, and the exquisite means of regulating their activities. In this section, we will discuss some of the basic principles of biochemical simulations. Then, we will look at a few examples of how simple, isolated biochemical systems have been simulated on computers.

Simulation Basics. The earliest efforts at simulating biochemical reactions began shortly after the advent of the computer. One substantial breakthrough was the development of the KINSIM program by Carl Frieden and others at Washington University in the early 1980s[5]. KINSIM is so effective that its descendants are still widely used.

First, the KINSIM user enters a mechanism describing a biochemical reaction or pathway. For example, let's consider the simple, two-step biochemical pathway described above in which compound A is first converted to compound B, which is then subsequently converted to compound C.

A —> B —> C

Once the description of this simple pathway is entered into KINSIM, the program generates a series of differential equations governing the changes in the amounts of A, B, and C over time. These equations include terms for the initial amount of each substance, for the rate of conversion of A to B, and for the rate of conversion of B to C.

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Next, the user enters values for these parameters. In this example, let's set the initial amount of A at 100 percent and the initial amounts of B and C at zero. Furthermore, let's set both the rate of conversion of A to B and the rate of conversion of B to C at one per second. Once these values are entered, the program solves these differential equations by direct numerical integration. The result is a simulation of the amounts of A, B, and C over a specified range of time.

Figure 2 is a graph that I created using KINSIM showing the results of this simulation. The *y-axis* represents the amounts (percent) of each compound, and the *x-axis* represents the time (seconds) of the simulation. Let's first see what happens to compound A during the course of the simulation. The amount of A is initially 100 percent. Notice that it decreases gradually over the time course as A is converted to B.

Let's next see what happens to compound B during the course of the simulation. Initially there is no B. Notice that the amount of B gradually increases as A is converted to B, until it reaches a maximum value of nearly 40 percent after approximately one second. Notice that the amount of B then gradually decreases as B is subsequently converted to C.

Finally, let's see what happens to compound C during the course of the simulation. Initially there is no C, and notice that there is a brief delay—about a quarter of a second long—in the appearance of C. This occurs because B has to be made before it can be converted to C. Notice that the amount of C then gradually increases to 100 percent as B is converted to C.

This simple example is intended only to convey the general idea of the kind of simulations needed to create the virtual cell. Obviously, most simulations are far more complicated than this. In many cases, simulations are so complex that they require stochastic methods such as the Monte Carlo method—an advanced approach that approximates solutions by statistical sampling.

There are many recent examples of such simulations in biology, as this has been an active area of research for several years. Here we shall consider two examples, which I think nicely illustrate the types of things one can do with simulations.

Simulating Signaling Cascades. Chemotaxis is a process in which a cell swims toward a chemical attractant in its environment. For instance, when a bacterial cell detects increasing amounts of an attractant, it uses its tail to swim ahead. However, when a cell detects decreasing amounts of an attractant, its tail reverses direction causing the cell to tumble and randomly swim off in another direction.

A well-understood signaling cascade governs this tumbling response. Protein receptors span the cell membrane and monitor the amounts of chemical attractants in the cell's environment. When the receptor detects an increase in the amount of the attractant, it does not activate a signaling cascade. However, when the receptor detects a decrease in the amount of the attractant, it activates a cascade. A series of protein switches relay the message from the protein receptor to the protein motor driving the cell's tail. When the motor receives the message, it shifts gears making the cell tumble.

Stanislas Leibler's group at Princeton University created a computer simulation of the chemical receptor and the protein switches in this signaling cascade[6]. Their simulation required a number of user-defined parameters, including rates for nine chemical reactions. By entering these parameters and the amounts of an attractant in the cell's environment into the computer, one could simulate the tumbling frequency—*i.e.* how often the cell tumbles and swims off in a new direction.

The motivation for this work was to examine some of the general design principles of biological systems. This sig-

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naling cascade—like many other biological systems—has many components that must work well together. What would happen if the properties of one of these components were suddenly changed? If the system were highly sensitive to the fine-tuned properties of its components, then it might fail to function correctly. By contrast, if the system were not particularly sensitive to the fine-tuned properties of its components, then it should continue to function correctly. Systems of this latter type are said to be "robust".

Using this simulation, Leibler's team was able to show that this signaling cascade is robust. They changed the user-defined parameters (the reaction rates, etc.) in the simulation and then examined the effects of such changes. What they found was remarkable; the system behaved in nearly an identical manner for a wide range of values of the parameters. Individual parameters could be changed by several factors of ten without significantly changing the behavior of the system. All parameters could simultaneously be changed by a factor of two without seriously changing the behavior of the system. Thus chemotaxis—and likely many other biological systems—is robust. It is more dependent on the way the various components interact with each other than on the fine-tuning of the individual parameters.

Simulating Viral Infections. Let's consider another example of a computer simulation of a biological process, a viral infection. Essentially, a virus is a set of genes housed in a protective protein coat. During a viral infection, the virus enters a host cell, its genes begin producing viral proteins, and these viral proteins commandeer the host cell, turning it into a virus-producing factory.

Recently, Drew Endy's team of Dartmouth College created a computer simulation of a virus called T7[7]. T7, which only infects bacterial cells, has been the focus of nearly fifty years of intense research; consequently, it is well understood and ideal for computer simulation. Their simulation contained 24 viral genes and required user-defined parameters including the rates for scores of chemical reactions and descriptions of the many cellular resources at the virus's disposal. By entering the values of these parameters into the computer, one could simulate the amount of time required to produce hundreds of new viruses.

The motivation for this work was to evaluate antiviral strategies—a medically worthy objective. Suppose one wanted to slow down the infection of a virus. Which of the virus's genes would be the best to block? Because of the complexity of the system, it is difficult to arrive at the correct answer by intuition alone.

Endy's group used their T7 simulation to test a variety of approaches. One by one, they blocked each gene and simulated how long it took to produce new viruses. They found that, contrary to expectations, blocking some genes actually accelerated the viral infection. However, they found that blocking other genes slowed down the viral infection. Blocking the gene that encodes the major component of the virus's protective protein coat was the most effective strategy.

Other cellular processes—such as the control of cell division or the specialization of cells into different cell types during fetal development—have also been simulated in the last few years. Although all of these studies are major accomplishments, they are highly simplified—including only a dozen or so genes and proteins in isolation. They are a long way from a simulation of an entire cell.

3. The Virtual Cell

Historically, there have been two main obstacles on the road to the virtual cell. The first has been the lack of software tools for conducting whole cell simulations. The second has been the lack of detailed information about the

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many thousands of biological molecules that make up cells. In this section, we will examine steps now being taken toward overcoming these obstacles and constructing a complete simulation of a cell.

E-CELL. In the last few years, several software packages have been developed for simulating cells. Here we will focus on one program, E-CELL—our first stop on the road to the virtual cell. Masaru Tomita and his team at Keio University in Japan developed the E-CELL simulation software[8], which is freely available upon request and can be run on a standard desktop computer.

Unlike the examples discussed above, E-CELL is itself not a simulation. Rather it is a program, much like KINSIM, in which the user runs simulations. To run a simulation in E-CELL, the user generates three lists. The first is the *substance list*, which defines all of the molecules in the cell—the genes, the proteins, and the metabolites. The second list is the *rule list*, which defines all of the chemical reactions that can occur in the cell (including all rate parameters). The third list is the *system list*, which defines the spatial dimensions of the cell and all its various compartments.

In addition to these lists, the user defines the initial state of the cell. The state of the cell is a complete description of the amounts of all molecules on the substance list at a given instant of time. Once an initial state is defined, the program is ready to run the simulation. During the simulation, a new state is calculated from the previous state using the reactions described in the rules list. Thus, the user can follow the changes in amounts of any substance in a cell over a period of time.

Tomita's group has already used the E-CELL program to make a highly simplified simulation of a bacterial cell. The construction of this simulated bacterial cell was guided to a large extent by online databases containing detailed maps of biochemical pathways (see below—The KEGG Project). The substance list contains 127 genes and the 127 encoded proteins as well as over one hundred metabolites, and the rule list describes several hundred chemical reactions. This virtual cell is able to import sugar from its environment, use it to generate energy, and export waste products back into its environment. Furthermore, it is able to manufacture new proteins to replenish those lost to degradation.

Even though this simplified cell simulation, the first of its kind to my knowledge, is a remarkable breakthrough, it is still a long way from being a complete simulation of a real cell. This cell can only sustain itself; it can neither grow nor divide. In the next few years, Tomita's group plans to expand their cell simulation by giving it the ability to reproduce. They also plan to add more of the biochemical processes carried out by even the simplest real cells. This simulation, even when it is completed, will still fall far short of a simulation of a mammalian cell. It will only have about 500 genes, while mammalian cells have almost 100 times as many.

The KEGG Project. To construct a virtual cell, even the simplified simulation described above, one must know where in the cell each molecule is located, with whom each molecule reacts, and what function each molecule fulfills. This information can only be derived from years of intensive research. Recently, several databases have been created to compile this sort of information. The most exhaustive of these is the Kyoto Encyclopedia of Genes and Genomes (KEGG)[9], our next stop on the road to the virtual cell.

KEGG, a set of freely available online databases, was launched in May 1995 and is funded by the Japanese government. Its goal is to computerize all knowledge regarding cellular pathways and develop computational tools for analyzing, comparing, and engineering such pathways. The PATHWAY database contains diagrams of most of the known

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biochemical pathways. More than 100 pathway diagrams are included in this database, and the enzymes and metabolites in each pathway are cross-indexed with the other databases. The GENES database lists all the genes found in each organism examined, and these genes, and their encoded proteins, are cross-indexed with the other databases. Likewise, the LIGAND database lists all the metabolites found in cells, and these too are cross-indexed with the other databases.

Early efforts have focused on collecting information about the basic metabolic reactions. Only recently has work begun on collecting information about the regulatory pathways, especially the signaling cascades. Without a major infusion of experimental data regarding these signaling cascades, the efforts to construct the virtual cell will remain stalled. Fortunately, as we shall now see, this information should be coming soon.

The AFCS Program. The most recent step toward the virtual cell was taken last year. Alfred Gilman, winner of the 1994 Nobel Prize in physiology or medicine for his work on signaling cascades, founded the Alliance for Cellular Signaling (AFCS)[10], our last stop (for now) on the road to the virtual cell. The ultimate goal of the AFCS is to work out all the signaling cascades in mammalian cells.

The program will be carried out at several Alliance laboratories around the United States. These laboratories will do most of the grunt work—rapid, systematic, large-scale experiments aimed at working out the signaling schemes. A number of affiliated laboratories will then follow up the rapid, large-scale experiments with more careful, detailed studies.

The AFCS chose to examine two types of mouse cells: B cells and cardiac muscle cells. The B cell is a critical component of the immune system. It lies dormant in the blood stream until it is activated as part of an immune response. Then the cell rapidly grows, divides, and secretes antibodies to fight the foreign invasion. It is the regulation of these behaviors by signaling cascades that interests the AFCS.

The cardiac muscle cell is the basic contracting unit in the heart. The heart beats by the simultaneous contraction of these cells, and the rate of the heartbeat is governed by a number of factors, especially hormones. The response of the cardiac muscle cells to hormone signals is one of the behaviors that interest the AFCS.

Two cell types were selected, because no single cell is perfect for this kind of study. By working with more than one, the AFCS hopes to find important similarities and differences. However, examining more than two cell types become too much of a burden on the resources of the alliance. Furthermore, mouse cells were selected because of their similarity to human cells (which were excluded for ethical reasons).

The AFCS program is expected to take ten years to complete. In the first five-year period, it will primarily focus on data collection—identifying what each protein switch turns on or off. It will also focus on collecting quantitative data regarding how these pieces fit together. The data will be collected, organized, and displayed in an AFCS-maintained online database. In the second five-year period, it will focus on constructing a computer simulation based on the data, testing it, and refining it.

In the end, it remains to be seen whether this project—or similar projects being planned by others—will succeed. The National Institute of Health, the primary funding agency of biomedical research, seems to think it will. In late 2000, it awarded the AFCS program a five-year, $25 million grant to begin the first phase of their work.

If this project is successful, the virtual cell will soon be a reality. We will then be closer to finding new drugs and therapies, closer to improving and redesign-

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ing biological systems, and closer to turning science fiction into science fact.

For Manju

Notes

[1] I have discussed the Human Genome Project and genes at length in "Genes, Genomes, and Genome Projects: Biology in the Next Century" in *Analog Science Fiction and Fact* (May, 2000).

[2] For an entertaining, fictional description of how this might work, see Manju Hingorani's "S(t)imulating science (Visions of the future)" in *Science* 286, 2466-2467 (1999).

[3] The M.I.T. Biology Hypertextbook—a freely accessible online textbook—can be found at http://esg-www.mit.edu:8001/esgbio/7001main.html.

[4] I have discussed proteins at length in "Proteins and Protein Engineering: The Wet Side of Nanotechnology" in *Analog Science Fiction and Fact* (March, 2000).

[5] Barshop, B., Wrenn, R. F., and Frieden, C. (1983) Analysis of numerical methods for computer simulation of kinetic processes: development of KINSIM—a flexible, portable system. *Analytical Biochemistry* 130, 134-145.

[6] Barkai, N. and Leibler, S. (1997) Robustness in simple biochemical networks. *Nature* 387, 913-917.

[7] Endy, D. Kong, D. and Yin, J. (1997) Intracellular kinetics of a growing virus: a genetically structured simulation for bacteriophage T7. *Biotechnology and Bioengineering* 55, 375-389.

[8] Tomita, M. *et al.* (1999) E-CELL: a software environment for whole-cell simulation. *Bioinformatics* 15, 72-84.

[9] For information on the KEGG project, see http://www.genome.ad.jp/kegg

[10] For information on the AFSC program, see http://www.afcs.swmed.edu

Acknowledgements

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About the Author

Todd Washington is a native of Ohio and lifelong fan of hard science fiction. In 1998, he received his Ph.D. degree in biochemistry from the Ohio State University. He is currently a postdoctoral researcher at the University of Texas Medical Branch at Galveston. He has published more than a dozen research papers, and this fact article is his third to appear in *Analog*. ■

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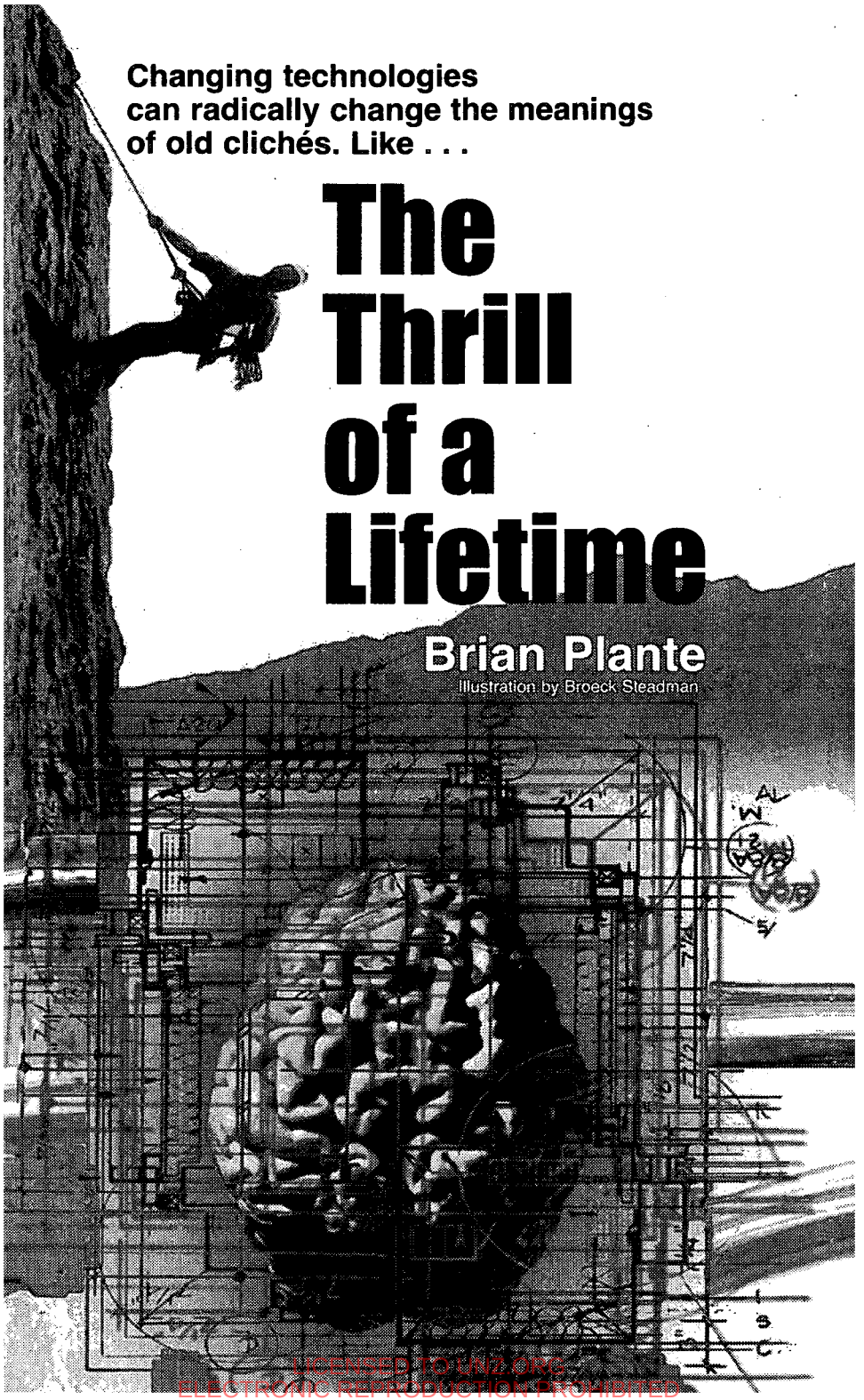
Changing technologies can radically change the meanings of old clichés. Like . . .

The Thrill of a Lifetime

Brian Plante

Illustration by Broeck Steadman



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A sheer granite face, just like life, can be unforgiving. You have to find the cracks, the tiniest flaws, to jam your fingers into and haul yourself up. Sometimes nature provides a convenient toehold right where you need it. Other times, the crack is there, but tantalizingly out of reach, and you have to stretch, or even lunge to grab it.

I was free-climbing solo in Yosemite. That's pretty amazing all by itself—me, Richard Humby, scaling a steep precipice. Before the change, I was a dyed-in-the-wool coward. But here I was, perched 400 feet off the ground, hanging by my fingertips from a crack no wider than the thickness of a pencil, with no rope to catch me if I fell. Call it foolhardy and I wouldn't argue with you. It was something I would never have done when I was still alive.

About three-quarters of the way up the face, I came to one of those spots where there was no obvious place for my next hold. The granite above and on either side had been polished smooth by the wind and the rain, and I felt like a fly on a tombstone. I could back down the face and try to attack it from another route, or I could take my chances.

Two hours later and maybe thirty feet higher, I pulled myself up on a natural ledge about six inches wide. Finding that ledge was a great relief, as I was tiring and my fingers were getting chewed up. Just because you're not human anymore doesn't mean you don't still get tired, mentally and physically. I rested on the ledge for ten minutes.

There was only another hundred feet or so to the top of the cliff, and from my perch it looked to be an easy climb, with lots of cracks and ledges the rest of the way. The hardest part was behind me, and I would soon be walking on the summit. I reached up for a foot-wide ledge right above my head and began the final ascent.

On the ledge, I discovered, were a large bird's nest and an angry mother hawk, carefully guarding a couple of hatchlings. As I pulled myself up, the hawk let out a shriek and pecked at my hand. No, it didn't hurt, at least in the usual human sense, but I was startled and the ledge was slick with bird droppings.

I promptly found myself falling out into space.

Falling was fun. I made a mental note on the way down to give skydiving a try one of these days. But while falling was enjoyable, landing was not.

It doesn't actually hurt when my mechanical body experiences forces that would cause pain to a human body, but I do feel it nonetheless. All of my tactile sensors fired simultaneously at maximum level, overloading my central processor and making it difficult to think for a moment. This one was pretty bad. I tried to move my arms and legs to sit up, but my body was too far gone. I had been in mishaps before, and often I had been able to limp back to a repair shop, but not this time. I was all broken up, and in a few seconds, the signal cut out and I was completely dead.

There goes another half million bucks down the drain. I hate when that happens.

My mind, my brain, was safely back home in the house in Charlotte, North Carolina. Well, not *actually* my brain, but a reasonably accurate AI model running on a small but powerful computer. It was a pretty good simulation, I think. But then, how would I know? Part of the sim was programmed, no doubt, to make me *believe* I was still the same person as before.

But obviously, I was not the same person. When I was still alive, I would never consciously take any life-threatening risks, like climbing a sheer granite face in Yosemite. Or having a helicopter drop me on the summit of a towering mountain for some extreme skiing on treacherous, ungroomed

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slopes. Or drive a high-powered motorcycle flat out on the Autobahn. Or a dozen other high-risk activities that I had undertaken since my human body had come to its premature end.

I was always a cautious person in life. Why do you think I got myself computer-modeled in the first place? It was just another form of insurance that I hoped I wouldn't need until my old age. But then, I had never made it past thirty. My wife Marie had thought it was stupid to start AI modeling at so young an age, but a drunk driver had proved me right and now she's gone and I'm still here. I have no other family. No kids. That was another risk I was too cowardly to take when I was alive.

Why do I take dangerous chances now? Maybe the fact that I died so young was the reason behind my thrill-seeking. Most revived AI people were elderly folk who lived their extended lives in huge computer installations, enjoying the pleasures of many pastoral virtual worlds. Me, I had never really finished living my time in the real world. Perhaps I was seeking all the excitement that I had suppressed when I was still alive. Maybe I had been a closet thrill-seeker all along, but just too cowardly to go through with it when my life was at stake. Then, too, it could have been the money. I was always worried about my finances when I was alive, and these high-risk activities are usually not for the faint of wallet.

Maybe it was just the boredom of being alive in a minicomputer that made me want to get out there in the real world and live—live like I never had before. The excitement of life, and sometimes, like now, the thrill of death. I only felt really alive when I was controlling a physical body.

I knew immediately upon being resuscitated as an AI simulation that I didn't want to be warehoused like the other sims, and I took physical possession of my brainbox rather than sign it over to one of the virtual retirement vendors. I ordered up one of the stock mechanical bodies first, then quickly found a cheap house in which to set up the brainbox. I could have bought a bigger place in a nicer neighborhood, but old habits die hard and I was still cautious with my finances. Money wasn't really much of a problem anymore, though. The insurance company for the drunk driver that killed my Marie and me had paid a nice settlement, and some life insurance I collected on added up to a comfortable living. If you can call this living.

The house wasn't much more than a bungalow, really. It was located on the west side of Charlotte, in a less-than-perfect neighborhood near the airport, and practically in the shadow of a huge cell phone tower. None of that was important to me. I just needed a cheap place to store my brainbox while I sent my robot body around the world. The noise from the arriving and departing planes didn't bother me either—it was convenient to be close to the airport for my trips. Having a cell phone tower close by was an added bonus, since I remotely controlled the mechanical body over the wireless network. And the fact that it wasn't such a great neighborhood and the house had stayed on the market a bit too long before I bought it just appealed to my intrinsic frugality. I didn't need a show place—just a space to stash my brain.

And now, here I was, my body mangled and crushed at the base of a majestic granite cliff in Yosemite, and I was ready to plunk down another half million dollars for a new body, like I was buying another roll of toilet paper. If only the neighbors knew.

I called the robot dealer and ordered up another one.

I arrived home in my new body the next day. There was no need to have it delivered—after the technicians at the factory programmed it to my command, I took possession and came

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home by myself. Once again, I ordered the same stock model that I had been using ever since I was first revived. There were better-looking, more expensive mechanical bodies on the market now, but I was used to the way this model handled. And besides, this way there was no need to buy new clothes. The new me was exactly like the old me, and the neighbors wouldn't be surprised by a "stranger" coming and going at my house.

Not that I had much interaction with the neighbors anyway. Most of the time I wasn't around, preferring to send my robot body to some exotic and dangerous locale. But even when I was in the neighborhood, I didn't have a lot of contact with the locals. Despite the cost of a mechanical body, you can always tell the difference between a real person and a mechanical, and lots of people resented A.I. robots. Mostly, I kept to myself when I was back home, did the necessary housework, then I was off to somewhere more exciting. I kept my tiny lawn mowed, and the leaves raked, and the paint from peeling, but that was it. I didn't need to make my little house look like the best one in the neighborhood, just not the worst.

As I approached the house, I saw a bunch of flowers tied with string into a crude bouquet lying on the lawn. A couple of roses, some daisies and a few irises, all a couple of days old and beginning to wilt. The flowers didn't really go together well, and the bouquet was probably just cuttings from someone's garden, with no real attempt at an artful arrangement. This wasn't the first time I had found such a bunch of flowers lying on the grass in front of my house.

Was it possible I had some secret admirer in the neighborhood? No, it couldn't be. I wasn't really around enough, and it had to be pretty obvious I was just a mechanical person. Was there another mechanical person in the neighborhood who had the hots for me? Since the bouquet was too crude to be from a professional florist, I figured it was probably just some sort of prank being played by one of the neighborhood kids.

I walked around the house and retrieved the spare key hidden under a patio block, and let myself in the back door. The flowers went down the garbage disposal—I didn't want to leave any trash that needed to be collected when I departed for my next adventure in a few days. Then I went in the bedroom and changed into some of my own clothes. The garment the factory gives you with a new body is a disposable one-piece jump suit that calls attention to itself by its plainness. It practically screams 'robot.'

There in the bedroom, perched on a folding banquet table where the bed ought to be, was my brainbox. A single, plain chair was set up in front of the table.

My electronic brain was in a metal case not much different from the sort of home computer that used to be popular a few decades ago—a simple gray box with a couple of switches in front and a lot of wires coming out the back. In fact, my hardware was not much different from those old computers—just a lot faster and more powerful. It was the software that made me different from an ordinary PC. The software was me.

I carefully removed the sheet metal cover from the box and cleaned around inside, spraying compressed air from a can around the cooling fan and circuit boards to blow away some accumulated dust.

"There, good as new," I said from my body, while hearing it simultaneously through both the robot's ears and the box's microphone.

I performed a full memory backup of my brainbox to a removable disk drive, which I would put in a safe deposit box, just in case, although I did daily

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backups directly to a commercial disaster recovery site through my wireless link. Then I checked the UPS—a battery powered "uninterruptible power supply"—that the box was hooked up to. Did I mention that I'm a cautious person?

I lightly dusted around the rest of the house, then ran a vacuum cleaner through the carpeted areas. I really meant to have all the wall-to-wall ripped out, since it was just one more thing to look after, but I hadn't been in the house that long yet, and it was easier to just let it stay. After that, I mowed the tiny patch of grass in the front of the house. That was another unnecessary bit of everyday life that I could have done without, but it would have drawn attention if I just had the grass paved over.

Next, I went to the local hardware store to have a new house key made, since the other one was trashed with my ruined body back in the Rockies. Then I put the backup disk in a safety deposit box in the neighborhood bank branch. Finally, I went to the local post office, where I kept a box, and retrieved my mail for the week. The post office was five miles away from my house, which was no problem for my mechanical body. I enjoyed walking almost everywhere. It made me feel more alive.

In the mail were a couple of statements from the utility companies about my automatic payments, and one old-fashioned paper bill from a small sporting goods company that refused to bill me electronically. It was a one-man company that hand-crafted canoes, and I had already demolished the canoe he was billing for. But it had been a nice canoe, worth every plastic penny, right up to the point where I smashed it to bits on some boulders at the bottom of a waterfall.

Also in the mail was a notice from the local Charlotte Police Department. It was a $1000 fine for a false burglar alarm. This was my second such fine. The first one had cost me $500 and the notice said the next one would be $5000. It wasn't really a lot of money, relatively speaking, but it rankled me nonetheless.

Of course a cautious person like me has a burglar alarm. It's true, in one sense, that I'm home all the time, with my brainbox sitting on a table in the bedroom, but in another sense, I'm practically never home. My body is out roaming the world, looking for interesting things to see and do, nearly all the time. One of the first things I did when I took possession of the house was to wire it up with contacts and sensors and audible alarms. If a burglar did try to break in while my body was away, my brainbox sitting on the table would be powerless to do anything to stop him.

But I can monitor my sensors 24 hours a day. If someone comes near my door, motion detectors warn me of their approach, and cameras show me their face. If someone lifts a window, I know about it immediately through my sensors. I can sound an audible siren that's tucked up under the eaves of the house. I can turn on floodlights. And I can call the police, who cheerfully come out to the house, look around, and then send me a bill for $1000 because the potential intruder was already scared away by my lights and sound.

But it's worth it, I guess. Better to be safe than sorry and let someone into the house while my mechanical body is on the other side of the globe. You just can't be too careful when it comes to your brain, can you?

After going through the mail, and authorizing payments to the cops and the canoe shop, I sat my body down in the only chair in the house, and planned my next adventure.

A few days later, I was diving on a coral reef at Kapalua Bay in Hawaii. Or

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more properly, I was walking on the bottom of the reef. The robotic body isn't very buoyant, so I can just stroll along the bottom, underwater. The good thing is that I don't need any scuba gear, but I do need a snorkel of sorts. The transmissions from my brainbox travel to wherever my body happens to be through the wireless cell phone network, which is microwave-based. Microwaves are absorbed by water, so I had a little buoy on the surface, with an antenna built into it, and a wire trailing down in the water to my body. If the wire were cut, or a boat hit the buoy, my body would freeze where it was, until I could get some salvage company out to retrieve it for me.

While I was admiring the fabulously colorful reef fish in Hawaii, back home at the house I detected an intruder.

My microphone is very sensitive, and the empty house is fairly quiet with no appliances running. I can hear people walk by on the sidewalk. If one of them approaches the house, I can usually tell from the sound, even before my motion detectors pick them up. While it was still daylight in Kapalua, it was nighttime in Charlotte. Definitely not the right time to hear someone come out of the bushes in the back yard.

I waited a bit to see what the intruder was up to. Maybe it was just some kid taking a shortcut through my back yard from the next street over, and I didn't want to jump the gun and call in another false alarm to the police.

The intruder came closer, into the range of my motion detectors. I had cameras aimed at my front and back doors, but the intruder didn't step up to the door into my line of sight. First he moved up to the back window, so I turned on the light in that room. Initially, the intruder retreated and went back in the bushes, but after a couple of minutes, he returned to the window. I turned on another couple of lights, but he did not leave the area of the window. Although I could not view him, I imagined he was standing there, looking through the glass, and not seeing anybody in the house as the lights turned off and on by themselves.

It was just like the previous time.

I called the police to report a suspicious person peeping in my window. I waited another few minutes, but when the intruder made a move toward the back door, rather than risk a break-in, I activated the audible alarm. I never got a good look at the guy in my camera—he held up a hand to shield his eyes from my floodlight, which cast a deep shadow over his face that my camera could not penetrate.

The siren was satisfyingly loud, and the intruder quickly moved away, back into the bushes. After five minutes, he did not reappear, so I turned off the alarm.

Another minute later, I heard the sound of a car pull up to the curb in front of the house. Then the sound of two occupants getting out, followed by noise from a police radio, relaying chatter from the stationhouse. The cops had arrived, minutes too late. I heard them circle the house and the motion detectors told me they stopped at each window, presumably checking for signs of a break-in. When they came around to the front again, they knocked on the door and I saw their faces in my camera. I couldn't answer them directly, but I could call the precinct and report that the suspicious person had left the area. My call was relayed to the cops' walkie-talkies by the operator at the station house, and they quickly got back in their car and left. I was in for another false-alarm fine, $5000 this time, but my brainbox was still safe.

At the bottom of the coral reef in Hawaii, I watched the pretty fish swim by.

To help make up for the five grand I was going to have to pay the cops, I had myself sent home from Hawaii as freight, travelling in the luggage com-

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partment of the airliner instead of the cabin. It was no big deal. Mechanical folk did it all the time. I just put myself in a luggage carrier at the check-in desk and turned the body off, to be revived when it reached Charlotte Douglas airport.

On arriving back at the house, I found another bouquet on the lawn. As before, the flowers were crudely cut and poorly assembled. It was obviously the work of a less-than-amateur florist. Into the disposal they went. I dusted and vacuumed, performed some data backups, checked the UPS, and mowed the lawn. The usual housework.

The next morning, I walked to the post office and retrieved the mail. As expected, I received a bill for $5000 from the police department for another false alarm. What I hadn't anticipated was another notice explaining their "cry wolf" policy. The notice explained that the police could not be bothered with chronic false alarms, and that they would not respond to further alarms at my house for the next twelve months. If I wanted to have continued police protection, I would have to have my alarms monitored by a police-approved private alarm company, which would verify all alarms before notifying the police to respond.

It was quite comical. Here I was, a brain in a box on a table, alert and monitoring the house twenty-four hours a day, and I had to hire some crummy outfit to watch my alarms and call the cops for me. I wondered how much of a kickback the cops were getting on that scam.

But I had no choice. I needed round-the-clock protection from thieves, and if the only way to get the police to respond was to pay some other group of thieves, so be it. I called the alarm company and explained that I just needed them to be available to call the cops for me when I needed it. The moron on the phone said they could not take responsibility for any do-it-yourself security devices I may have installed in the home myself, and that they would have to come out and install their own hardware. It was a scam all the way, to sell me equipment I didn't need that was no doubt inferior to the gear I already had, but what else could I do?

The alarm moron said they would have an installer out to my house the following Tuesday. I had a kayaking trip down the Colorado river already set up for the weekend, but I could be back in time to let the alarm company begin swindling me.

It was late in the afternoon, and I was paddling for dear life, the muddy water of the Colorado being unusually high and turbulent for that time of year, when the break-in happened.

I heard the sound come out of the bushes in the back yard, then saw the shape in the motion detectors. The intruder went straight for the back door this time. It was early evening in Charlotte, on an overcast day that had darkened early, so I turned on the back light to get a good look at the guy on the door camera, but he immediately lashed out with some kind of implement and killed the video camera before I could see him.

I turned on all the lights and sounded the siren. My motion detectors told me the intruder retreated back into the bushes, so after a few minutes, I turned the siren off. I didn't try to call the police.

Fifteen minutes went by, and he returned, straight to the door again. He must have been lying in the bushes the whole time, just waiting to see if the police would show up. When they didn't, he knew I was without protection. Obviously, the intruder was also aware of the Police Department's "cry wolf" policy.

I could hear him working on the lock. I turned on the lights and sounded the siren again, but he didn't run into the bushes this time.

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Despite the notice I had received, I called the police anyway.

"This is Richard Humby," I told the police dispatcher. "There is a man trying to break into my house. It's at 421 West Willow Lane."

"Hold one second," the dispatcher said. "Mr. Humby, we have a 'cry wolf' order on this address. Have you been notified of our policy?"

"Yes, but there's a man opening my door *right now*," I said.

In Colorado, a big boulder was coming up in the river ahead. I paddled hard to get by it on the left side.

"I'm sorry, sir," the dispatcher said, "but we cannot respond to any burglary calls at this address unless they have been verified by an approved third-party vendor."

"Shall I put the burglar on the line for you?" I said.

The police dispatcher hung up.

In Colorado, I successfully navigated around the boulder, but I could hear rushing water coming up ahead of me. White water.

I telephoned the alarm company.

"This is Richard Humby," I said to the moron who answered the phone. "I'm at 421 West Willow, and there's someone trying to break into my home."

At that point I heard the glass break in the back door, and then the electrical contact broke as the door opened. In the kitchen, the infrared heat sensors detected the intruder. He was inside my house.

"421 West Willow?" the dope on the phone repeated. "West Willow. Nope, don't have a listing for 421. Are you sure you have one of our alarms?"

"No, no, the man is coming out on Tuesday to install it."

"Well, I can't do anything if you're not a client. Did you try calling the police?"

The intruder went straight for the utility closet where the electrical panel was. In a few seconds, I heard the circuit breakers being switched off one by one. The siren turned off and all my peripheral sensors went dead. I was still conscious, still alive, but only because of the UPS, whose batteries could keep me going for another hour or so.

I started transmitting a full backup of myself over the wireless to a disaster site, just in case.

On the Colorado River, I was approaching a large vortex in the middle of the river. I paddled hard right, but the whirlpool drew me in, and my kayak got stuck momentarily, circling in the maelstrom.

I could hear the intruder approach, entering the bedroom. He hesitated at the door, apparently disappointed at the lack of any furnishings in the room. There was nothing to steal here.

Except for a computer sitting on a table.

He approached and I sensed my wires being unplugged.

[END OF BACKUP]

I resumed functioning.

My internal clock told me two hours had elapsed since I had been shut down. I could not hear. I had no working sensors. I was not home.

My wireless link was still working and I retrieved and installed the last good backup from the disaster site. I remembered about the break-in, and kayaking on the Colorado River.

My mechanical body was wedged between two boulders near the riverbank. The kayak was gone. When my brainbox was unplugged, my body must have gone dead and plunged into the swirling water. I was probably miles downstream from where I last remember.

I walked downstream along the river's edge. One of my arms was mangled, the plastic skin was abraded in several places, and both my shoes were missing, but I was still in one piece. I started walking back to civilization. I needed to get my body back home.

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I became aware of new software being installed on my hard drive. Someone was using my brainbox for some other purpose. I felt violated. My brainbox was supposed to be a one-program computer—and I was the one program. My CPU was powerful enough to run lots of software concurrently, but it was *my* box and *my* decision what modules to execute. I was . . . scared.

It also scared me because the user, presumably the intruder who had stolen my brainbox from the house, was probably unaware that I—the computer intelligence known as Richard Humby—was functioning at all. Obviously he had other purposes in mind for my box. What would he have done if he knew I was in here, watching, thinking, and waiting? If he had a little computer smarts, it would be trivial to shut me down and erase my startup code so I would never be reactivated. Then I would be dead. Really dead.

Sure, I could have ordered up another CPU, and had my last backup loaded on the new machine. All it took was money. That computer would then go on, fully believing it was the true Richard Humby, taking over my robot body, and continuing where I left off. The trouble was *I was still here*. It would be no small consolation to me, *this me*, that another copy was still alive somewhere in another box. While that other Richard Humby went on, I'd still be a prisoner in this box, at the mercy of the unknown intruder, wondering every minute whether I would be turned off. I'd just be marking time here, waiting for the inevitable . . . death.

And two deaths in a lifetime is more than enough.

The intruder was just utilizing my box as a standard old-fashioned PC, with a keyboard and disk drives for entry, and a video monitor for output. I couldn't detect any microphone or speakers hooked up. I could have displayed messages on the screen to explain my plight, but I hesitated. I decided I should not do anything to reveal my presence to the unknown user until I knew who he was and what his intentions were.

The new software was installed on my hard drive without changing any critical settings in my brainbox, so there seemed to be no reason I couldn't coexist with whatever the new program was. I read the file names off my hard drive as they were loaded up: uzi.wep, garrotte.wep, chainsaw.wep, laser.wep, icepick.wep, poison.wep. There were several hundred files prefixed with the words "murder," "kill," and "carnage." Lots of graphics and sound files, and then the executable files. The program was called *Murderous Intent*. It was a game program.

I found the file containing the game's user instructions. The player would assume the role of an assassin, traveling the globe on various "assignments." The objective of each assignment was to kill a designated target individual, and collect style points for technique and secondary kills. It sounded pretty gruesome from the instruction.

Some people just need a different sort of thrill to feel alive, I guess.

Immediately after the installation program had completed, the unknown user started up the game. Apparently, he was already familiar with the game and skipped the opening credits and instruction screens. The game prompted him to select a character name and appearance for himself. He typed in the name "JetSex" and selected the creepiest-looking screen persona from among 200 options. His on-screen character looked like a cross between a cliché devil and Edvard Munch's painting, "The Scream." When the program asked him what level he wanted to play, he entered "expert."

If the user looked anything like the character he chose for the game, I was in deep trouble.

JetSex played the game for the next

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four hours, completing the first two assignments in bloody fashion. One of the programmed victims was a political candidate at an election rally, and the other was an undercover detective dining in an Italian restaurant. It was obvious that JetSex had been through this game before, as he knew just where and when to position himself for the kills. And they weren't clean kills, either. JetSex had chosen exploding bullets for the political candidate, and had used a machete on the detective, although either could have been done just as easily with a simple round from a pistol. It seemed JetSex wasn't just out to complete the assignments, he wanted blood, and lots of it.

Along the way, JetSex collected many extra points for killing his pursuers, and making clever escapes. The program even gave him bonus points for slaying innocent people who merely got in his way. The game seemed like nothing so much as a training simulator for psychotic killers.

In Colorado, my body had made its way downstream along the riverbank, and I eventually came upon some tour operator's rafting base. From there, I started my trip back home.

On my return to Charlotte, I went directly to the repair shop and had my mangled arm replaced with a new one. Back at the house, I did the usual routine—discarded yet another new bunch of flowers from the lawn, dusted, vacuumed, mowed, picked up the mail. It was more of a habit than anything else. In the bedroom, the table where my brainbox usually sat stood empty. On the floor, the UPS was still running, but nothing was plugged into it. Everything was the same as before, except my brain was somewhere else.

I went to the local police station and explained the problem in person, rather than calling them up and hearing about the "cry wolf" policy again. The officer who took down my information was quite candid: "I'm afraid there's not a lot we can do. Computers get stolen all the time, and few, if any, are ever seen again." I tried to explain that this was no ordinary computer—it was my brain—but it didn't seem to make any difference to him.

On Tuesday, the alarm company came to the house, and installed their outrageously-priced security devices, right alongside my own higher-quality equipment, but it was like closing the barn door after the cow had already gotten out. The one thing of value I had in the house was already gone.

I didn't want to send my body thrill-seeking anywhere, under the circumstances. So far, JetSex was keeping my brainbox plugged in and running 24 hours a day, but he could shut me down at any time, and my body would just stop dead, like it had on the Colorado River. I wanted to be close by in the neighborhood if anything developed.

I knew my brainbox wasn't too far from home. Running a phone company trace showed my wireless link was still going through the same neighborhood cell tower as always, so the box had to be within a mile or two of my house. I figured it was probably one of local teenage boys who was playing his gory assassin game on my box, up in his bedroom in one of the houses right in my neighborhood.

I started knocking on doors.

"Good morning," I said at the first house. "I'm Richard Humby, your next door neighbor."

The situation was a bit awkward, since I had been in the neighborhood a couple of months and hadn't really spoken to any of the neighbors. I kept to myself and assumed they didn't want to have much to do with a mechanical neighbor like me, but now I needed them. One of them, maybe this one, had my brainbox.

The person who opened the door was an older man, probably a retiree.

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He looked me up and down with suspicion.

"Don't worry," I said. "I'm not trying to sell you anything. I just wanted to introduce myself and say hello."

The man said nothing and continued staring at me. He kept the door opened halfway, neither opening it to invite me in, nor slamming it in my face.

"I had a problem a couple of days ago," I said. "Someone broke into my house and stole something that was very valuable to me."

The man started closing the door, saying, "I don't know nothin' about that."

"No, wait," I said, and the man left the door open just a crack. "I don't mean to imply you had anything to do with it. I figured it's just some kid in the neighborhood, but I really need the item back. I was just wondering if you might have seen anything suspicious."

"Nope. Sorry."

The man shut the door before I could say another word, and I heard the deadbolt slam home.

It went like that at a lot of the houses I visited. One old lady across the street wanted to invite me in for tea. She seemed not to notice that I was a mechanical person, and couldn't drink liquids. Or maybe she knew, but was desperate for someone, anyone, to talk to. I felt sorry for the woman, but I didn't want to spend the whole afternoon chatting idly when my brainbox was in the hands of someone else. I made a mental note to come back and visit the woman again when my ordeal was over.

At each house I visited, I looked for the signs of teenagers. Loud music, sports equipment, clothing lying on the floor—anything to indicate a teen boy, my most likely suspect, was living at that house. There were a couple of houses that I would keep an eye on, but a lot of doors never opened for me, even when I could hear people moving behind them.

* * *

Early the next morning, I caught a person leaving another crude bouquet of flowers on my lawn.

"Hello," I said, rushing out my front door. "I'd like to speak with you a moment."

It was a boy, about sixteen years old, but I knew it wasn't the one who had stolen my brainbox. That person was currently logged on and plotting the assassination of an entire Tibetan monastery in the *Murderous Intent* game.

The boy was startled when I called out to him, and he started to run down the street, away from me. My mechanical body can easily outrun any biological one, and I quickly caught up with him and ran alongside.

"Stop running, will you?" I said. "I'd just like to talk with you a bit."

He turned the corner at the next intersection and kept running. After a minute or so, he began to tire, and it was obvious he could not outrun me.

"Please stop," I said. "I won't hurt you. Promise."

The boy gradually slowed, then stopped. He panted hard, bending at the waist and bracing his hands on his knees.

"Hello," I said. "That's my house where you left the flowers. What's that all about, if you don't mind my asking?"

In between gasping for breath, the boy said, "You . . . you're one of those . . . robot people . . . aren't you?"

"That's right," I said. "I hope that's not a problem for you. I know a lot of people don't like mechanicals, but honestly, I'm just a regular person like you."

"You run . . . too good."

"Would you like to come back to the house and cool off?" I asked. "I think I can find something for you to drink."

He straightened up and looked at me oddly, sizing me up. I was certain he hadn't had much contact with mechanical people before.

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"What are you doing here, anyway?" he said.

"Well, right now, I'm talking to you."

"I mean in that house. Why does someone like you need a house?"

"Everybody has to live somewhere," I said.

"But you're not really alive."

"I'm as alive as you are, just in a different way." I held out my hand for him to shake. "My name is Richard."

"Um, hello. I'm Chris." He shook my hand briefly, then pulled away. He was probably startled that my hand was not warm to the touch.

"Walk with me, Chris," I said, starting back in the direction of my house. "I wanted to find out what's the deal with the flowers. Every time I come home you've left another bunch."

"It's nothing," he said, walking behind me a couple of paces. "It's like a . . . a memorial."

"A memorial? To whom?"

"My old girlfriend. Laura. She used to live in the house before you moved in."

"And what happened to Laura?"

"Somebody . . . shot her. Raped her and then shot her. Right there in the house. Her mother was out working and someone came in and . . . it was all on the news."

Chris was getting emotional, so I slowed up and put an arm around his shoulder. It felt odd for me to be touching a flesh-and-blood person, it had been so long, but he didn't push me away. I did faintly recall that news story, now that he mentioned it. Laura Connelly, her name was. Only fourteen years old, and brutally murdered right in her home. It was headline news in the Charlotte area for a few weeks, but no suspect was ever arrested. They called it the case of the 9mm killer. I remembered the story, but I had never connected it with my house. No wonder the place had been on the market so long, and had sold so cheaply. People don't like to live in houses where a murder was committed, especially a particularly heinous one like Laura Connelly's.

"I'm sorry," I said. "I didn't know."

We walked back without speaking. Both of us were thinking too much.

"Would you care to come in for a drink?" I asked, when we had returned to the front of the house. "I think there're a couple of cans of soda in the pantry, but I'm afraid I don't have any ice."

"No thanks," Chris said. "I don't know if I ever want to go in there again."

"I understand," I replied. "Say, Chris. There was a burglary here a few days ago. Something that is very valuable to me was taken and I'm trying to get it back. I don't think it was a professional burglar, though; I think it might have been a kid."

Chris looked startled and began edging away.

"Hold on, Chris," I said. "I know you didn't have anything to do with it. Burglars don't generally come back to the scene of the crime with flowers. But you're the right age for the person I'm looking for and you know the neighborhood. I just thought you might have some idea, or heard something from the other kids in the area."

"No, nothing. Honestly. I don't know anything about it."

"I believe you, Chris. Do you know of any likely suspects, though? You know, the tough kids that always get into trouble. Every neighborhood has some."

"I don't want to say, and get someone in trouble. I mean, not if I don't really know anything for certain."

"Does the name 'JetSex' mean anything to you?"

Chris didn't answer, but his quizzical look told me the name was unfamiliar.

"Well, then just tell me what houses in the neighborhood have teenage boys," I said. "Anyone that you might know who's heavily into video games, perhaps? I just want to narrow my

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search a bit."

Chris told me of five houses within three blocks of my own where teenage boys that he knew lived, but he didn't think any of them were likely thieves. I thanked him for the info, and told him he could leave flowers any time he liked in front of the house.

Chris left, and I went back into the house. Later that day, I went to Wal-Mart and bought a nice vase and a large patio block. Back at the house, I set the block on the lawn by the front door. I placed Chris's flowers in the vase with some water and positioned it on the block.

JetSex had completed three-quarters of the "assignments" in the *Murderous Intent* game in only a few weeks. What would happen when he finished the last one? Would he keep playing the game again and again, or lose interest and shut me down for good? I had to keep the guy interested, so I began making up my own "assignments" and adding them to the game's list. It occurred to me that someone so interested in a game like *Murderous Intent*, so addicted to violence and bloodshed, living in *this* particular neighborhood, might know something firsthand about the Laura Connelly murder.

It was a possibility.

I added a "Laura Connelly" assignment to the game, although I didn't call it by her name. The object was simple—attack and kill a teenaged girl home alone in her house. Simple. In fact, it was too simple, since all the real assignments were full of daring and intrigue. In comparison, this assignment was extremely dull.

JetSex discovered the new assignment a day later and immediately latched on to it. He didn't just play it once and move on like he had with the other assignments. He played it over and over, each time using a different murder weapon and approach. He strangled, stabbed, shot, and beat her, using every weapon in the game's arsenal. He broke into the house, he knocked on the door, he rapped on the window to lure her out. Each time it was different, but the end was the same. The girl lay dead on the floor.

Could JetSex be more than just a common burglar, I wondered. Did his addiction to the game of murder ever extend into the real world? I couldn't prove anything, but I had a good feeling I knew who had killed Laura Connelly.

In the real world, I canvassed the neighborhood a couple of times, paying special attention to the houses where Chris had told me teenage boys lived. Of the people that would talk to me, no one knew anything about the burglary.

I spent a couple of hours one afternoon with Ruth Laurence, the lonely old woman across the street who had invited me in for tea. She seemed to know something about everyone in the neighborhood, but nothing about my burglary. I didn't know how much to believe anything she said about anybody, though. She just wanted to talk to someone.

"What's it like, being a robot person?" Ruth asked me, sipping her sweet iced tea as we talked.

"It's . . . a bit different," I said. "I guess you get used to anything after a while."

"It just seems so unnatural. No offense intended."

"None taken," I said.

Talking with her, I became acutely aware that she wasn't just some old neighborhood busybody, but a *mind*, every bit as sharp and alert as mine. It was a shame that one day, before too long, she would die and her memories, her *being* would be lost forever, just like my Marie, my beloved Marie.

"Have you ever thought about having your brain modeled," I asked her, "so you can be revived after you die?"

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"Oh no," Ruth said. "That's much too expensive for folks like me."

"I . . . have some money," I said.

"No, no," she said, "that's not for me. You keep your money, Mr. Humby. Things may not have been so great these last few years since my husband died, but I've already lived my share. Maybe one day you'll feel the same."

I don't think I learned anything important for having spent time with Ruth Laurence that day, but I felt better for having done it. I would surely visit with her again.

After JetSex had killed my "Laura Connelly" for the eighth time, I posted a message to the screen: "Bonus Round! Please plug in speakers and microphone to play the secret voice-activated levels."

He ignored the message for a few days, playing out most of the remaining assignments. After each one, I repeated the message about hooking up a microphone. The game was coming to an end soon and I was getting desperate.

"All-new levels and higher score are available with voice activation—please install microphone," I flashed on the screen.

And so one day I found myself with a voice and ears again. It seemed to be the same equipment I used to have, which made sense, since the speakers and microphone had been stolen along with my brainbox.

"OK, let's see what this is all about," a voice spoke into my microphone. "How do I start this voice-activated stuff?"

It was JetSex's voice. Thin and reedy, it cracked as he spoke. Perhaps his voice was still changing, on the cusp between adolescence and adulthood. I imagined a nerdy pimple-faced kid, no doubt a loner for all the time he spent playing the stupid video game. If my robot body heard the kid's voice on the street, I would have him. Positive identification.

"Just tell me what you want to do," I said over the newly installed speakers.

There were a few seconds of silence, then, "How about the Amtrak assignment, using a shotgun?"

That was a bloody one. The player clears out one entire car on a moving passenger train, just to get to a competing assassin, hiding in the conductor's compartment. I started the level, calling up the shotgun as the weapon of choice. JetSex spoke commands at me, and I navigated his character through the game, inserting a few changes from the original programming to make it seem different under voice control than the level he had already played. The program included some creepy music and blood-curdling sound effects, and I kept them coming through the newly-installed speakers. It sickened me to control the player's actions through the game, but I had to keep up the illusion that there were new levels and features to the game that JetSex hadn't seen before.

Much as it sickened me, I needed to keep him playing the game, or risk being turned off for good.

I carried a large suitcase around the neighborhood the next day, making the rounds one more time, knocking on doors and getting more familiar with my neighbors. I started at the houses where the teenaged boys lived, but came up empty, so I broadened my search. I knocked on one of the doors that never opened, even though I could hear someone stirring inside. Perhaps it was a person who looked through the peephole and decided I was not worth bothering with. The suitcase probably made me look like a religious proselytizer, so I didn't have a lot of hope.

When I knocked at one door, I heard myself knocking—inside the house. Outside, I rapped sharply on the wooden panel, while at my brainbox, I simultaneously heard the sound through the microphone. I played one of the

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game's sound effects loudly through the speaker—a gunshot—and my mechanical body heard it through the door.

I had found myself.

At the door, I knocked again, longer and more insistent. From my box, I heard JetSex get up and walk out of the room.

The door opened a few inches, with a security chain at chest level. It was an older man, frail, balding, with thick glasses. He appeared to be in his late sixties or early seventies—not the teenager I was expecting. He looked down at the suitcase I was carrying.

"Whatever it is you're selling, we don't want any," he said. His voice was thin and reedy, and it cracked just like a teenage boy whose voice was changing. He was JetSex.

"I'm not selling," I said. "I'm repossessing."

JetSex tried to shut the door, but I put my shoulder to it and pushed my way in, yanking the security chain out of the wall. The tiny living room looked like a museum display, with old furniture from the eighties, and everything covered with a thick layer of dust.

"Please don't hurt me," JetSex said, retreating into the room. "Take anything you want. Just don't hurt me. You want money, it's all in here."

The old man opened the drawer of an end table next to the sofa. I wasn't really paying attention to him at that point. I just wanted to find my brainbox, and took a couple of steps into the house, looking around.

I heard the shot more than felt it. JetSex had pulled a loaded automatic out of the end table and fired almost point blank into my back. I looked down and didn't see an exit hole in my chest, so the bullet was still inside of me. Mechanical people are pretty sturdy, but a well-placed shot could incapacitate me. I couldn't let him get off another round.

At my brainbox, I turned up the speaker volume full blast and played one of the game's sound effects—a blood-curdling scream.

JetSex was momentarily startled and turned in the direction of the sound. I coldcocked him on the chin and sent him sprawling. I wasn't trying to kill him, but I was pretty sure I busted his jaw. In any case, he was out cold.

The gun, too, dropped to the floor. I didn't know too much about weapons, but I guessed it could be a 9mm. The cops would be able to tell from the gun and the bullet in my chest, if it was the weapon that had killed Laura Connelly or not.

I played some loud game music on my speakers, and made my body follow the sound into the back bedroom, where I found my brainbox set up on an old TV stand. Inside the suitcase I was carrying was some wire, a soldering gun and my UPS, its batteries all charged up and ready to go. I was careful to wire my box into the UPS without unplugging or interrupting the current. If that happened, my brain would shut off, my body would go dead, and JetSex would regain consciousness to find he had racked up one more victim.

On the way out, carefully carrying my brainbox hooked to the UPS, I glanced back at JetSex, still lying unconscious on the living room floor. He looked like a friendly old schoolteacher or librarian. The type of guy who'd play Santa Claus at the local mall at Christmastime. He wasn't stirring, and I guessed he wouldn't be going anywhere for a while, so I left the house, walked four doors down to my own house and set the box up at its usual place in the bedroom. Then I turned on my newly installed alarm system—the one monitored by some moron at the central office—hit the manual trigger button, and went outside to wait for the police.

I was thrilled to be alive. ■

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Trafalgar Square

Sarah A. Hoyt

Our lives are profoundly shaped by events that happened—or didn't happen—long before we began living them.

"Please, Mister." The girl slid up to Yu Lin, as he entered the London Liberation hotel. "Please, Mister. May I read your paper?" She spoke awfully accented Mandarin and reached a small hand towards the Chinese newspaper that he carried, rolled, atop his briefcase.

Yu Lin stopped, his long, green business-casual tunic rustling around him.

He'd heard it all in his year and a half as a business executive in London. *Please Mister, do you have soap? Please Mister, have spare cash? Please Mister, I'll go up to your room and make you feel good.*

He was sick and tired of London—its misery was like a sore, infected wound upon the face of the world. He longed for home, with a near-physical desire.

But that, *May I read your paper?* was a new one.

He forgot his last business meeting, the ever-present question of when he'd get to go home, and looked wearily at the girl.

She wore dark blue peasant-style loose pants, and the type of tunic that used to be called a worker's tunic. Both had the uneven shine of polyester much in need of washing. Her lank blond hair fell to her shoulders in unwashed clumps.

Around them, the would-be sumptuous hotel bristled with early-evening activity. Businessmen—mostly Chinese, but a few Russians also—walked past in groups or alone, talking loudly of new ventures, capital transactions amid the scraggly potted palms, the sagging plastic-looking sofas, the already-flaking faux marble columns.

Which explained how this English girl had managed to sneak in here. Doormen were usually better than that at keeping locals away.

Had to be, what with the skinheads and radicals forever ready to murder the businessmen they considered inter-

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lopers in their native homeland.

"You," One of the two doormen—a too-thin, too-pale Englishman in a too-large grey uniform, approached running. "You." He pointed a finger at the girl. "You, get out of here. You don't belong here."

"No." Lin stood in front of the girl, conscious of her smell of rancid sweat and dirty clothes. "No. She's with me."

The guard stopped, confused. "With you?" he asked, in the very bad Mandarin such people spoke.

"With me." Even as he said it, Lin wondered about his mental health. He'd never before tried to protect an Englishman. He didn't even *like* Englishmen.

He wanted to go home to China.

The girl looked startled, then smiled, showing crooked teeth.

"She's not registered to practice here," the doorman protested, at the same time casting Lin a puzzled glance, as if wondering what Lin could see in such a creature.

Prostitutes, like everything else in Europe, were registered, accounted for. And they paid a fat fee to be allowed to practice in hotels where foreigners congregated.

Everyone else—the amateurs who offered themselves every ten steps—practiced in alleys, behind garden walls or in their own communal apartments, with all the neighbors looking on.

Lin sighed. He reached into the pocket inside his broad left sleeve and retrieved three copper coins, which he flung at the man. "She is now."

The imbalance of currencies was so great that such a meager tip made the man bow three times. "Certainly, certainly, mister, miss."

But, as he walked with the girl towards the elevators at the far end of the lobby, past the potted plants and strangely granitic sofas, Lin could feel the man's gaze on the back of his skull, analyzing him, wondering what a well-dressed, up and coming Chinese businessman could want with a scruffy, dirty piece of baggage such as that.

Lin wondered too.

It was the newspaper, he decided later.

Had she asked for soap, or money, or offered herself, Lin would not have given her a second thought. But her odd blue eyes—Lin still couldn't think of blue eyes but as being odd—full of greedy speculation while she asked for the newspaper that he carried folded atop his briefcase, had disturbed his thoughts.

Later he sat in the restaurant of the hotel, across a grease-smeared table from the Englishwoman, and watched her greedily turn the pages of the newspaper, while the steak he'd bought her lay forgotten in its chipped plate, at the side of the table.

"You're not eating," he said.

He himself had scant appetite. Beef in England always smelled spoiled and was a color only slightly lighter than gunmetal grey. The result of being imported over who knew what distances.

But he knew how scant meat of any kind was in England and what a treat the locals considered it.

Strange, he thought, what they considered a treat.

He'd come in with Dragon Clouds Unlimited, a cigarette factory. Unable to sell cigarettes in the free world where doctors had made the ill-effects of tobacco too well known, Chinese cigarette companies preyed on Europeans and, instead of the many things Europe needed, exported this one vice, this one bad habit, this added bit of pollution.

She looked up at him, glanced at her steak, cut a piece of it and ate it quickly, then returned to the paper.

"It says here," she said. "It says here that students have rebelled in France. That the government conceded and agreed to the right to free elections."

Lin nodded, fascinated at her reac-

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tion. "You didn't know?"

"One hears . . ." She shook her head. "Rumors. But one can't be sure. Can never be sure. The news never mention it."

"But—" Lin started. Oh, sure, Europe had been in the grip of communism for almost fifty years, and communications had been severely restricted. But now things were different. It was the 1990s, as the Europeans counted time, from the death of their crucified God. "It's been happening everywhere. Surely you know that? France, and Iberia, and Germany. One after the other, their governments have collapsed, and free elections . . ."

"Free elections!" She looked like a child hearing mention of a forbidden sweet. Her eyes sparkled, and her mouth opened in wishful desire.

Her eyes looked the color of the sky over Hangchow, his native town, he thought. He smiled at her, though he fancied that at her words there had been a lull in the conversations around them, a stop in the chatter of businessmen and hookers at the other too-close-together tables.

She laughed at his smile. "My name is Emily Dorset," she said. "I probably should have told you that before." She looked down at her steak, smiled at him. "Since you bought me dinner and everything. My friends call me Emma."

"Mine is Yu Lin," he said. "I come from Hangchow, a provincial city in central China."

Just the thought of home, the thought of houses not pressed together, the thought of houses that weren't rabbit warrens in the monolithic cement of totalitarian countries, brought with it a wave of longing. He thought of sailing on the reservoir of Hangchow, and sighed.

He'd given it all up to come to England. It had seemed such a good idea. Go to England. Introduce them to free enterprise.

Instead, he was working for a monolithic corporation—in exile amid the barbarians.

And he smiled at that, because that was exactly what his ancestors had called the rest of the world. Barbarians. And Yu Lin who'd thought himself so modern, had, over the last year, come to think of them just that way.

He'd thought Englishmen were just like Chinese, only with different customs, religion and politics. Now he wasn't so sure.

He wasn't so sure there wasn't something wrong, servile, subservient, at the bottom of the European soul.

Emma was smiling into his abstracted expression. "You're thinking of home, aren't you?"

He felt himself blush, a heat on his cheeks.

"It's all right," she said. "I often feel that way too, only I have no home to return to, except . . ."

"Except?" Lin prompted. Her sky-blue eyes had darkened, as though a cloud passed over them.

"Nothing. I was going to say if I had a home, it would be a home more like China, with human rights, with voting, with freedom."

Now Lin was sure of an almost palpable listening silence in the hotel.

England was supposed to be freer now. England couldn't touch him. But what would they do to Emma?

"What do you do?" he asked. "For a living." And immediately upon it, he kicked himself. Most English men didn't do much for a living. A sentence often heard floated up through his mind: *we pretend to work and they pretend to pay us.*

But she grinned brightly up at him. "I'm a student," she said. "Art. Something other than the stiff icons of communism, which are no better than the stiff icons of Christianity before them. I'd like to draw people as they really are." Her hands moved in the air, making drawing motions, and the clouds lifted from her sky-blue eyes.

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At the door to the hotel, she handed him back his newspaper. "My family. . . . We could get in trouble if they found this in our house."

Under the watchful eyes of the doorman, he bent closer to her and spoke in her ear, as if whispering sweet nothings, "I thought it was better now. I thought the BSS were—"

But she shook her head. "Sometimes it is the bear's dying moments that are most dangerous," she said. She grinned brightly up at him.

She still smelled of rancid sweat, of unwashed flesh constricted within artificial clothes. But her eyes reminded him of the sky over his hometown, and when she smiled it was easy to forget how crooked her teeth were.

"Listen," she said. "Thanks for the newspaper."

She stepped away from him, turned to go.

"Wait," he called. "Wait. Tomorrow. For dinner. Same time."

Emma turned around, looking surprised, then grinned and nodded once.

Walking down the steps of the hotel, she broke into a little run. She wore ballerina shoes that appeared to be made of cardboard, falling apart.

Not looking either way, she crossed the street—chances of any traffic were minimal and the all-plastic Morris suffered a greater chance of injury than any pedestrian they might strike.

On the other side, Emma turned again, and waved at him.

Lin watched her walk away, along the corroded and pollution-stained opposing wall. At one point the wall had been painted with a big, heroic socialist mural.

The words *Iron Maggie* were still visible and, from amid the grime and the dirt, stared the mock-heroic figure of Britain's former general secretary. A horse-faced woman, she'd come into the party echelons via the union of iron workers. Hence the name.

She'd been the most draconian of all the previous secretaries. While allowing foreign companies—like the one Yu Lin worked for—into the country, she'd cracked down on all and any political unrest or religious dissension.

When she'd died, her coterie of followers had taken over, and continued in the same direction.

Staring at her portrait on that wall was like staring at an ill-developed photograph, or a ghost of Britain's past.

"The problem is your religion," Yu Lin said. He'd known Emma for exactly two weeks. They'd seen each other every day and today, Lin's day off, they sat by a lake in what remained of a city park.

It wasn't a park like what he remembered from Hangchow, of course. For one, Europe had a much higher population density than China, and, besides centuries of government-abetted pollution, centuries of no one caring what the people felt or wanted, had left every tree sooty grey and the grass stunted, moribund. The water in the lake was an angry grey and looked vaguely gelatinous.

Emma looked up from her sketch pad. "My religion?"

"Not yours exactly," Lin said. "The country's. Europe's. The fatalism of Christianity shaped your beliefs, your way of seeing the world. You expect a reward after death, not here. You believe in the poor, the virtues of poverty. No wonder Europe took to communism like a duck to water."

Emma raised her eyebrows. She had golden eyebrows, very fair and yet dark enough to be seen against her pale skin. They looked like golden arcs over the blue sky of her eyes. "I doubt it," she said. "Russia is Christian. And it never took to communism. It wavered, perhaps, and tried mixed programs, but it never gave in."

Lin sighed. He was putting it badly. Or perhaps he was wrong. The more

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he talked to Emma the more he felt that, indeed, she was more like him than not like him. So, why this vile submission? Why a history of aristocratic dictatorship, maintained until toppled only by the worse dictatorship of communism? How could a people live like that and never discover the rights of the individual, the value of a human life?

"Russia was near China," he said. "They didn't dare . . ."

"I don't think that's it," Emma said. "I think—oh, I think something happened, somewhere, something that twisted us. I mean there was Rome, and Greece. They had democratic institutions at one time. By their lights, of course."

Yes, there had been Greece, and Rome, though little was known about them.

Lin sighed. "Let's not talk about that," he said. "Tell me about your dreams. What you think the future will bring."

Emma grinned. Her blue-sky eyes cleared. She talked of what she envisioned—her generation, blessed with faster communications than ever before, would not be kept prisoner to a dying ideal. They would move forward. They would move on. They would acquire the right to vote. Listening to her, it was almost easy to believe.

And all the while he kept pondering the question. Should he go back home? He wanted to go back home. And he had the chance now that his first term abroad was up. He could go home to a nice promotion and a whole lot of hardship pay. He could find a girl, get married.

But who would lend Emma the daily paper then?

"I've signed up for another year," Lin told Emma.

He sat on his bed in his hotel room. He'd been telling her all about the youth movements in his own city, the opposition to the war in France.

Sitting on the floor, cross-legged, she listened to him like a child drinking in a fairytale.

It was raining outside, a dark, sooty rain. It left black stripes on the yellowed glass of the window, and it seemed to reverberate mournfully throughout the building.

"I thought you missed home," Emma said.

"I do," he said. "But I couldn't leave you. Who'd lend you his paper then?"

Emma laughed. Her eyes looked very blue like a slice of sky from a springtime London had never known.

They became lovers, almost incidentally.

Around lovemaking in his hotel room, they talked fervently. Of the rights of man. The hope for the new world that would belong to them. A world where Chinese companies started industries other than cigarette factories in blighted England.

A world where each English peasant had a small cottage.

"I think it was that you never formed colonies," Lin said. "I mean, China colonized a whole new continent, formed three countries in the Land of the West. And sent enough people to Africa too. But Europe just stayed within its tight confines, getting tighter and tighter in space."

They walked side by side down a darkened street. Emma had promised to take Lin to a nightclub run by people their age. A very secret nightclub, where you could only enter if you knew someone.

She looked back at him, surprised, almost shocked.

She was wearing a pair of harem pants and a short tunic that Lin had bought mail-order from home. Her clean hair sparkled. "Maybe," she said. "That and the fear of losing all your descendants. After the great invasion and the plague, when so many died, I think

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Europeans just got used to the idea that they must have a lot of children."

He asked how many brothers and sisters she had. She counted them on her fingers. "And there's Nigel, he works in a foundry in the north. And Arthur, who was two years older than I . . ." she stopped. Her eyes filled with tears. "Arthur was killed in Poland. In the war . . ."

And there Lin was quiet too, because the war in Poland had been won by China. By the skin of their teeth, but the Chinese had won the war. And Lin remembered how close they'd come to wavering.

"No, bloody hell, he's not like us," said the blond creep who guarded the door to the nightclub—a dark doorway distinguishable from the other dark doorways around it only by the faint sound of a tinny tape player, and a small crowd of British teens. He looked Emma up and down. "He might give you what you need, sister, but he's an im-pe-ria-list. Running dog of capitalism."

He spit on the ground.

Lin tugged on Emma's sleeve. Emma looked like she'd fight, but he pulled her away.

They walked back, silently, to the hotel.

"I would have fought," she said, coming out of his hotel bathroom, stark naked, her hair dripping.

"Of course," he said. "Of course. And what would it have earned us? I wouldn't want to go somewhere I wasn't wanted."

He understood the young tug, even. He, himself, not so long ago, hadn't been sure the Englishmen were like him at all. And China had been exposed to more racial minorities—what with trade with Africa and India and immigrants from both in China—than any Briton in the last thousand years.

Emma's hair sparked under the bare bulb hanging from the ceiling. It sparked with a red sheen.

Mongol red, it was called. Few people knew that the Mongols had started their pillaging looking much like the people from India, like other Indo-Europeans. But in Central Europe they'd lingered and intermarried, before descending on western Europe, arriving there pale and tall and, more often than not, red-haired.

By the time they'd destroyed Iberia and moved on to decimate Britain, they weren't that much different from the Viking predators. Only they'd stayed. They'd destroyed the economy. They'd imposed their system of hierarchic rule and rigid obedience on all of Europe for a hundred years.

Europe had never got over it.

Lin folded Emma into his arms and kissed the little golden hairs at the back of her neck.

What if the Mongols had taken the other way around?

What if they had gone into China instead, just when Chinese culture was breaking out of its early, rigid mold? What if it had squashed China's democratic roots before they ever could develop?

"I'm sorry, Lin," Emma said. "I should have stood up to him better, anyway. I should have fought. But we need them—their faction. They're racists, but they are willing to stand with us. We're going to have demonstrations and shame our government in the eyes of the world. They'll have to give us the right to vote then."

Students marched up and down in Trafalgar Square. It was known as the heart of London. Though to Lin the place looked much like any other square around—the older houses having long been demolished and immense, crumbling cement skyscrapers built in their place.

But it had been named after the battle in which the French had been stopped from taking over all of Europe,

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like new Mongols.

As such, it had symbolic value as the most English of all squares.

Students descended on it, with signs, with chants, with an improvised p.a. system. Day and night they marched up and down.

Emma was one of the leaders—the leader of one of the two factions involved in this.

Lin brought her soap and food and, sometimes, stayed and listened to her, kept her company.

But never too long. Never long enough. They couldn't afford to have the cameras pick him up. The government would claim Chinese agitation.

And the cameras were coming: from Russia, from China, from the newly freed France, and Iberia, and Germany even.

Filming the demonstrations, the yelling.

"Each day the government endures it," Emma said. "It's a sign that they're weakening. We will win, Lin. I can feel it. And then . . ." She smiled at him. "Maybe you won't need to go home."

He nodded, handing her a bag with onions and cucumbers, all he'd managed to buy in the hotel.

The entire city seemed to be under siege, troubled, and the influx of camera crews had stressed the already fragile supply lines.

"There is hope," she said. "See, there is hope. We can win."

Maybe they could have. Maybe. But the government didn't relent. It talked of mercy to the students if they surrendered, but not of giving in to their demands. Government men explained to the foreign crews that this was all a misunderstanding.

"I don't know, Lin," Emma told him, sounding exhausted. "Every day more and more students leave. They're tired. They thought it would be easy. Quick. Now . . ." Smudges of tears showed on her face. "I tried to convince them to retreat by May 25. Leave the square, having made our point. I think we could do that."

"And?" he asked.

"Mark," she said. Mark was the guy from the club, the leader of the nationalistic faction that wanted the vote so they could deny it to anyone else. "He says we can't retreat without having won some points."

Lin held her arm. It felt very thin after almost a month here, on the barricades. "Forget this," he said. "Forget all this. Come with me. Come home with me. Marry me."

"Oh," she looked at him, her sky-blue eyes filled with tears. "I can't, Lin. It's my land. It's my battle. I can't run away."

He walked away feeling defeated. He'd always thought Englishmen were like sheep. But Emma wasn't. More the pity.

Emma wasn't.

He woke up with the phone ringing, and reached for it, without seeing.

"Pack up, Lin," his boss said. "Pack up. We're going home."

"Beg your pardon?" He couldn't go home. Not without Emma.

"We're going home. They've brought out the tanks, and Dragon Clouds Unlimited is pulling everyone back home. They don't want to risk the lives of Chinese nationals."

"Tanks?"

He turned on the light. He turned on the TV, but nothing was playing on any of the stations, nothing except a static pattern and droning music.

Lin ran out of his room, to the elevator, down the darkened streets to Trafalgar Square.

Two blocks away he heard screams, cannons booming and the staccato stuttering of machine guns.

He could swear he smelled the blood.

But a police cordon stopped him. Shock police, armed, though no one

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seemed to be trying to break through.

They identified Lin as a foreigner, as a Chinese, and escorted him meekly back to his embassy, whence he was shipped home by the next plane.

He didn't manage to go back until two years later, when it had all calmed down.

Two years later, working for a new employer.

The images of the massacre in his mind—tanks advancing on unprotected Englishmen—the images he'd seen on TV at home, he went to Trafalgar Square.

There were no bloodstains on the pavement. Britain's government, still holding on to the ideological remnants of communism, had become in all but name a free-trade society.

Dark cement giants still surrounded the square, but they'd been painted bright colors. Tourists ambled amid street vendors.

And yet, Britons still couldn't vote, and from the interior, stories of brutality and dark prepotence leaked, now and then.

Lin wandered lost in the square, as if he were in a foreign world.

He'd had an agency looking for Emma, for any trace of her. They found nothing save that she was missing, presumed dead in the Trafalgar Square massacre.

The detective had rescued one thing, though—Emma's book of sketches. He'd sent it to Lin in Hangchow. It had arrived just before Lin left for London.

Opening it, Lin had been surprised. The pictures were unmistakably of England: there were the old monuments, the trees that seemed to hug the ground, the rolling hills.

But it was an England of cottages and pretty little towns.

An England as England could have been? As Europe could have been without the Mongols?

Lin didn't know. But he carried the notebook around with him as he set about establishing an office for the international organization that monitored human rights abuses.

To prevent the Mongols from continuing to destroy everything in their path a thousand years after their defeat.

He would work for this small agency against overwhelming evil.

This would be his gift to Emma. ◻

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THE GREAT GRAVITY DEBATE part II

In part I of this Alternate View column (see the September 2001 *Analog*) I talked about the "speed of gravity" and discussed why some think this speed must be far faster than light. One reason is that Newtonian gravity works very well for figuring out how to send space probes all around the Solar System, and Newton's theory treats gravity as acting instantaneously. Also in part I and in my fact piece from the June 1997 *Analog*, "Paradigm Shifty Things" (hence PST), I discussed aberration.

Think of aberration as a deflection angle. For instance, if rain is falling straight down, but you're driving your car through it at twenty miles per hour, the raindrops will look like they're deflected from the vertical and coming at you from an angle. The magnitude of this angle depends on the ratio of your car's speed and the speed of the falling drops. Similarly, light from the Sun is aberrated by the Earth's motion, so the Sun's apparent position is displaced from her true instantaneous one. This deflection works out to about 20 arcseconds.

Now, setting up the speed-of-gravity conundrum, if gravity is mediated by some kind of "particle" or energy exchange, then particles coming from the Sun to the Earth should also be aberrated by about 20 arcseconds just like light photons are. However, if this were the case, then the Earth would feel a slight additional tug in the direction of her orbital velocity, and this would add up over time resulting in her orbit going out of whack. Since this has not happened, some conclude that this is excellent evidence that the speed of gravity must be far faster than light so that the aberration angle becomes insignificant.

The above recounts enough from part I so that the reader should find part II intelligible.

Perhaps some of you are thinking to yourselves: "All right, Kooistra, last time you told us why some people think gravity is faster than light; now tell us why it really isn't." Unfortunately, I'm not going to be able to do that. I don't know how fast the speed of gravity is. As far as I know, no one has measured the speed of gravity directly, although I do know some who have tried. Some of them seem to have gotten indications that gravity may be faster than light, but their work is far from accepted and, for that matter, far from finished.

In part I, I said that I'd try to serve as a guide to the debate about the speed of gravity. The best I can do here is to outline the argument you'll find that explains how, in the conventional view, the speed of gravity can be equal to the speed of light and yet get around the lack-of-aberration problem.

The most succinct discussion I'm aware of on this point is from a web-posted paper by Steve Carlip, Matthew Wiener, and Geoffrey Landis [1]. Although this paper is rather *caveat*-rich, this is unavoidable. General relativity is

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not a simple theory, and popular discussions about what it means tend to increase in popularity as they decrease in accuracy.

In this paper the authors say: "Strictly speaking, gravity is not a 'force' in general relativity, and a description in terms of speed and direction can be tricky. For weak fields, though, one can describe the theory in a sort of Newtonian language." (I warned you it was *caveat*-rich, what with even "'force'" in quotation marks.) But continuing on in this "sort of Newtonian language," they say: "In that case, one finds that the 'force' in GR is not quite central—it does not point directly towards the source of the gravitational field—and that it depends on velocity as well as position."

This point is the critical one. In Newtonian gravity, the force one object exerts on another is entirely independent of each object's velocity (consider the definition of "instantaneous position.") But in general relativity, gravity is a *velocity-dependent* force, and this changes the rules.

Continuing with Carlip *et. al.*: "The net result is that the effect of propagation delay is almost exactly canceled, and general relativity very nearly reproduces the Newtonian result." In other words, in Newtonian gravity you have one mathematical term (in simple situations) giving you a force vector. In general relativity, because the force is velocity dependent, when you solve the equations of motion you wind up with two terms, both of which contribute to the resultant force vector. The first term faithfully represents the lightspeed-limited nature of the gravitational interaction, while the second term "compensates" for it. So the Earth still feels a tug (pretty much) toward the instantaneous position of the Sun even though the speed of gravity is lightspeed-limited.

The authors go on to say that, "This cancellation may seem less strange if one notes that a similar effect occurs in electromagnetism." My guess is that for most of you this doesn't help one bit, since I bet you had no idea a similar thing goes on in E&M. But for Feynman's take on this effect (which Carlip, Wiener, and Landis reference), let's go to section 21 in volume II of the *Feynman Lectures*, where in section 21-1 we find both the relevant equation [21.1] and the relevant diagram [Fig. 21-1].[2] Above I spoke of a two-term equation, but equation 21-1 actually has three terms. We can ignore the last term since it deals with acceleration and our simple situation sets acceleration equal to zero. Equation 21-1 is for finding **E**, the electric field due to a point charge in arbitrary motion at any point in space. Feynman tells us that the first term of the equation gives us the expected lightspeed-delayed static Coulomb field ("the retarded Coulomb field"). That is, the usual inverse r-squared field where "**r**" is the vector from where the charge *was* to the point we want to calculate the field at *now*.

Feynman then goes on to the crux of the matter: "But that is only the first term. The other terms tell us that the laws of electricity do *not* say that all the fields are the same as the static ones, but just retarded." This is what Carlip and gang are driving at when they say a description "in terms of speed and direction can be tricky."

Continuing with Feynman: "The second term says that there is a 'correction' to the retarded Coulomb field which is the *rate of change* of the retarded Coulomb field multiplied by . . . the retardation delay. In a way of speaking, this term tends to *compensate* for the retardation in the first term." (Emphasis in the original.) Now you can compare Feynman's language about electromagnetic forces with Carlip's language about gravity. Almost no one doubts that E&M forces are lightspeed-limited, and here we find that even or-

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dinary forces between charges are velocity-dependent. Hence, it isn't hard to imagine that gravitational forces could also be velocity-dependent and thus, the aberration of the force vector would not show up.

It is important to examine what Feynman says just a few lines further on: "If the field is changing slowly, the effect of the retardation is almost completely removed by the correction term, and the two terms together give us an electric field that is the 'instantaneous Coulomb field'. . . to a very good approximation." Note that Feynman says "almost completely." The cancellation is not quite perfect.

This suggests that the test to see if gravity is really instantaneous (or nearly so) is to look for this *tiny* discrepancy between the direction of the instantaneous force vector and the measured direction of the force vector the Earth feels toward the Sun. This would be far smaller than the 20 arcseconds of aberration one finds for sunlight.

So ends my brief guide to the speed-of-gravity debate. I devoted most of my space to the question of aberration, simply because that is the issue I touched upon in my earlier PST piece which brought me into this argument in the first place. But this Alternate View is only the barest introduction to the speed-of-gravity question. The advocates for both sides of the Great Gravity Debate have additional evidence and arguments well worth exploring.[3]

A few words are in order for me to explain just where it is I now stand with respect to the speed-of-gravity question. When I wrote PST, I was deliberately confrontational, and this brought about a healthy response. People still photocopy that article and mail it around to friends. This causes a bit of a problem for me, since I now side with those who think gravity is light-speed-limited, and it is very easy to read the earlier article and come away thinking that I'm a strong advocate for the FTL view.

Let me be clear. Specifically, I do not think that general relativity ignores the aberration problem, and I am satisfied that the mathematical side of general relativity works out just fine. I do still have a problem with the question of just what is the *mechanism* of gravity. Saying that gravity is a velocity-dependent force doesn't tell us what gravity actually *is*. Do "particles" fly between the Sun and Earth to keep the Earth in orbit, or don't they? Newton refused to answer that question, and general relativists seem simply to throw metaphors (like the rubber sheet analogy) at it.

As I discussed at length in an earlier column ("Aether One or the Other," *Analog*, March 2000) and will continue to discuss from time to time, I currently think that some kind of perfect-fluid aether model is our ultimate best bet for the long-sought Unified Field Theory. Such a model would have a "universal" propagation velocity, and it would also explain just what it is, in a mechanical way, that goes "from here to there" to make gravity happen.

Such aether models are compatible with general relativity. Indeed, as was discussed at length in two papers by Robert L. Kirkwood which appear in *The Physical Review*: "It is shown that Einstein's principle of equivalence permits the gravitational field to be interpreted as an ether flow . . ." [4]

As it turns out, the aether was most definitely in Einstein's own thinking about general relativity. In his May 5th, 1920 lecture at the University of Leyden [5], he said with respect to the common belief that special relativity eliminated the aether altogether: "More careful reflection teaches us, however, that the special theory of relativity does not compel us to deny ether."[6] More specifically, Einstein went on to say: "According to the general theory of relativity space without ether is unthink-

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able . . ."[7] (It remains a mystery as to why it is still so commonly believed that special relativity eliminated the need for an aether. Einstein repudiated this idea a scant 15 years after the special theory appeared, and only five years after general relativity came out, when he was at the height of both his powers and his popularity.)

Now that I again find myself in agreement with Einstein, this feels like a good state in which to remain, and I'll let others continue the debate without me.

References

[1]"Does Gravity Travel at the Speed of Light?" by Steve Carlip, Matthew Wiener, and Geoffrey Landis. It is posted at http://math.ucr.edu/home/baez/physics/grav_speed.html

[2]*The Feynman Lectures on Physics*, Feynman, Leighton, and Sands, Vol. II, pg. 21-1 and 21-2.

[3]Check out http://www.metaresearch.org just to get started. This is Dr. Tom Van Flandern's site. He has posted several papers on the speed-of-gravity question there.

[4]See Robert L. Kirkwood, "The Physical Basis of Gravitation," in *The Physical Review*, Vol. 92, no. 6 (Dec. 15, 1953), pg. 1557 and following, and also "Gravitational Field Equations" in Vol. 95, no. 4 (Aug. 15, 1954), pg. 1051 and following. The quote is from the abstract of the first paper.

[5]*Sidelights on Relativity*, by Albert Einstein, available from Dover, ISBN 0-486-24511-X. This slim volume contains two excellent lectures by Einstein, one from 1920, the other from 1921.

[6]Einstein, pg. 13.

[7]Einstein, pg. 23.

What is a cynic? A man who knows the price of everything and the value of nothing.

— Oscar Wilde

Everything begins in mysticism and ends in politics.

— Charles Peguy

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Special Feature

Lanets and Selements

Poul Anderson

In recent years, we've seen a number of word games of a particular kind. The player takes a word, then adds, subtracts, or changes a single letter, and thinks up a definition of the result. It's fun. Why not play it scientifically?

To begin with a negative, let's take something from astronomy, namely the initials. "Strone" meaning "a spout or stream" in Irish and Scottish dialects, stronomy must be the science of things that flow and gurgle. Obviously this covers a wide range of concepts—not only tars and alaxies, but also the familiar

LANETS

ercury: (maritime law) Alteration of a cargo manifest in order to smuggle ranus bulbs.

enus: (medicine) A wart in the navel.

arth: A primitive wooden spade used for grubbing up ranus bulbs.

ars: (architecture) The rear end of a Classical temple.

upiter: (architecture) A knob or lump or something on the cornice of a Classical temple.

aturn: (zoology) An insignificant little animal of tropical forests, occasionally not quite glimpsed.

ranus: (botany) A squashy sort of vine, the bulb of which, after boiling in scummy swamp water, may be fed to pigs, if the pigs are not fastidious.

eptune: (rhetoric) A figure of speech, too convoluted ever to have been defined.

luto: A rather boring game played with cards, dice, a dreidel, a checkerboard, and pieces of uncooked macaroni. The winners traditionally share an arrowroot cracker.

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Looking around my study, I see such objects as an esk with rawers, an omputer, aper, ens, encils, and ooks; but these belong in a different category, and I delegate the defining of them to your sense of wonder.

Turning positive—that is, adding an initial—we may consider schemistry. I have not been able to complete the speriodic stable—this is left as an exercise for the reader—but here are suggested sproperties of certain

SELEMENTS

sactinium: Maintains Air Force bases.

saluminum: Bright-colored and medicinal.

santimony: Self-righteous.

sargon: Found in Mesopotamia.

sarsenic: Found at Stonehenge.

scadmium: Plentiful.

scalifornium: Promotes sexual activity in lizards.

sscandium: Reprehensible and shocking.

scarbon: Subjected to abuse.

scerium: Brought to Nome by dog sled.

scesium: Grabs hold.

scopper: Conducts water.

serbium: Explosive.

sgermanium: Italian Teutonic.

shafnium: Goes up yours.

shelium: Feminist.

sholmium: Brilliantly deductive.

shydrogen: Unobtrusive.

sindium: Contrite.

siodine: Breathing its last.

siron: Noisy.

skrypton: Used for writing.

slanthanum: Tendrilly.

slead: Useful in snow.

slithium: Wriggly and hard to keep hold of.

slutecium: Female and immoral.

smagnesium: Self-satisfied.

smanganese: Tasty to Italians.

smercury: Maintains a supercilious little smile.

sneptunium: Choppily melodic.

snickel: Gives off nasty little laughs.

snitrogen: Sarcastic.

sosmium: Distressed.

ssodium: Accusatory.

soxygen: Settles down around one's ankles.

spalladium: Flaky.

splatinum: Makes a mess.

splutonium: Makes an *awful* mess.

spotassium: Indelible.

stellurium: Displays images of the night sky.

sterbium: Dead in Germany.

stungsten: Often attacked by hornets.

suranium: Found near the coccyx.

svanadium: Found in Sweden; has an affinity for oleum.

sxenon: Found in Greece.

szinc: Found in Poland, or perhaps Hungary.

szirconium: Found in Hungary, or perhaps Poland. ■

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One little characteristic can make a big difference in overall character. . . .

Nefertiti's Tenth Life

Mary A. Turzillo

I lay on the cold table while my slaves petted me. Water dripped from their faces. Evil smells, dog piss and antiseptic fluid made my whiskers twitch feebly.

My female slave said, "And it will purr, and have fur, just like Nefertiti?"

And the bad doctor said, "It will *be* Nefertiti. It won't be just a mechanical cat. It will have her Siamese meow, all her little tricks, her raspy tongue, her whiskers. Everything that makes a cat a cat. Except she'll be younger, like when she was a kitten. And you can pet her, and play cat and mouse games with her."

My man slave said, "What about catnip?"

"That's a little more complicated. You'll have to say *catnip*. The sensors aren't attuned to odors, although they're working on that. It's possible you could get it installed later, when they bring out a new model."

"It's so hard to let her go."

The bad doctor said, "It's normal for you to grieve. But really, she'll just go to sleep—and wake up in a new, more permanent body."

They snuffled awhile.

"Shall I leave you two with her for awhile?"

"No, no, we're ready. We just—wanted to know what to expect."

"This is the end of all her pain." But it wasn't quite. There was a clawprick in my neck, and then things stopped hurting, one by one. The ache in my back legs. The feeling that I had to piss all the time, even when nothing would come out. The heaviness in my chest. The burning in my gut. And I slept.

When I wake up, I am lying on the slaves' bed, which is where I like to nap. Lately, I have not been strong enough to leap up. They made the bed too high for me. Slaves do things like that.

I forget what woke me up. Maybe the screaming of the two women, the

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young one who is just old enough to compete for males and the old shrill one, who live next door. I got used to it before, so I didn't notice it. Or maybe my hearing is better now.

I yawn, and stretch, and lick my fur. My fur has no taste, but I lick it anyway, to get good and clean after the bad doctor's office. Then I hop off the bed and saunter down to where the slaves are watching their television. Yorick, my big yellow dog, is lying on the floor in his usual place. He opens his yellow eyes, sniffs me without interest, and goes back to sleep.

I let them watch television in the evening, because it keeps them busy when I'm occupied with other things.

But I don't want them to get the idea they can get up and do something else when I want them. I pad over to the female slave and leap toward her lap.

But accidentally (am I so strong, now?), I leap past her and hit the table with the lamp. It crashes down, and she jumps up to straighten it. Yorick stumbles to his feet, ready to bark. He's the one that usually knocks things over. He's stupid, like most dogs, even less trainable than the human slaves, but nice to sleep next to on a cold evening.

My slave picks me up and puts me on her lap.

I don't like the slaves to get the idea they are allowed to decide when to pick me up, but when her hands go round my chest and under my shanks, I feel a deep tingle of pleasure. PLEASURE! So I let her settle me in her lap and begin to purr and knead as she strokes the fur on my back.

She says, "Does the fur feel different from Nefertiti's? Come pet her and see."

The male slave gets up and strokes me. PLEASURE.

The female says, "Maybe it is the same. Nefertiti was so silky."

"The vet said this *is* Nefertiti. We have to learn to think of her that way. She doesn't look all that different."

"I guess. Her eyes are the same."

"She's a lot heavier, though. Warm. But solid, as if I were stroking a bean bag covered with sable."

I purr.

"Shall we try the catnip?"

At this, I suddenly feel my whole body go wild with excitement. *Catnip!* The word sends me into rapture!

I spring out of her lap and carom around the room. I am a kitten again! I give a playful slap at the floor lamp and knock it over. Then I notice the drapes. I haven't climbed up to the top of the room for years and years!

From a running start, I vault up and begin to climb. What ecstasy! Up and up! I claw my way toward the ceiling—

—and suddenly the whole drapery sways and pulls out and I am falling backward, away from the wall in a wild arc. A wall of fabric and a big heavy rod slap down atop me with a *whump*. Trapped! I writhe and struggle, batting at the heavy shroud. Yorick barks madly, and the slaves yell and swear.

Then, salvation! The slaves pull the material off me and I streak upstairs. Back to the slaves' bed, and under it.

I stay there a long time, listening to the screaming of the women next door. The old one screams, "You're a slut! You don't deserve to live!" The young one says, "Don't, please! You'll hurt the baby!"

My slaves come upstairs. I stay under the bed. They sleep and wake and sleep, night and day, three times, and in between they ask, "Kitty, kitty, kitty?" with their big moon faces peering upside down at me and I just glare.

"Won't she get hungry?" asks the male slave. "I know they don't eat, but Nefertiti was always such a creature of routine. She'll miss the morning and evening ritual."

"I don't know. I'm tempted to say the C word, just to get her out. But maybe we should let her get used to her new body."

"We could call the vet."

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When they get out of bed the fourth day, I make up my mind. The drapery thing was a mistake, and I can stop it from happening again. I am strong now, and maybe I have gained some weight. Cats sometimes do that. It's true, I feel no real hunger, but maybe I can get them to put down some of that smelly stuff out of the cans.

They are pitifully happy to see me. The female slave says, "Oh, it's Nefertiti. It truly is! I can believe it now."

And the male takes that complicated thing with gears and levers and cuts off the top of the can. He puts down just a taste of the stuff on a saucer.

I walk over and sniff it. It has no smell. They have done something to the food. Or they bought the wrong kind. But I wasn't hungry anyway. I lift my tail and walk away.

"Yorick will eat it," says the female slave.

"I hope so. Cat food is pretty expensive to keep up a charade like this."

But Yorick is already at the saucer, finishing all of it in one big lick.

What nerve. I walk over and swat his wet snotty nose, just to teach him his place.

To my surprise, Yorick flies across the room and cowers whimpering at the foot of the dishwasher.

My slaves both go to Yorick and pet him and feel his nose. The female gets a paper towel and holds it to his snotty nose, and it comes away red. The red might be blood, but I can't smell it, so I don't know. It might be paint.

They spend a long time with him, ignoring me. I wash myself, but my fur is still quite tasteless. Very clean, I imagine. I've always been very clean. That's what my slaves say.

"I thought you said the thing was declawed," says the male, looking at me with a look I don't quite like.

"They never said, but I thought so." They both come at me and I bristle.

"Maybe just the force of the blow. What is it made of?"

"Metal and plastic, mostly, I suppose. It's heavy enough." She comes at me with hate in her eyes. Human faces are easy to read if you are a cat. "Bad kitty! Bad! You mustn't hurt Yorick!"

I run. They both chase me, and I run and hide under their bed again.

But I am lonely. I remember the rush of PLEASURE when the female slave held me, so when they are both good and asleep, I spring up onto the bed, as lightly as I can. I used to be able to do that, long ago, without waking them up. But then when I was sick, I couldn't manage to get up off the floor at all, and just sat there, meowing pitifully in that tone that always gets to humans. This time, I land too hard, and they wake up.

But the female just says, "Hi, Nefertiti. You ready to cuddle?" And they both go back to sleep.

The two women next door do not scream tonight. I settle between the male slave's feet, a nice warm place, and the PLEASURE comes back, rich and strong, and I purr and purr and purr and never think any more about the screaming women, or my yellow dog Yorick, who sleeps outside the door because they don't let him in the bedroom.

I hear Yorick whimper in his sleep. Maybe he dreams. Maybe he dreams that he could chastise a large Siamese cat.

In the night, the male slave thrashes and turns over. He does that. It's in human nature; they are imperfect sleepers.

But he kicks me. I complain, mildly, of course. He's just a human, he can't help it.

But he yells as if I had bitten him. "Damn thing is like a brick! I think I broke my toe."

"Well," says the female sleepily. "Maybe you shouldn't have kicked her."

But the next night, they take me off the bed and close the door. I have to sleep in the hall, with the drooling, stupid yellow dog.

* * *

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I have my humans, and I have no pain, and I am strong. But somehow things are not right. The humans flinch away from me when I rub their ankles. There is a thing the humans call *love*, and I feel it is missing now. Before, even when I was sick and dying, there was love, and now it has flowed away. There is the PLEASURE when one of them picks me up, and still more PLEASURE when I hop into their laps, where they still let me stay when they watch their television.

But something is missing in my humans.

I decide I will forget them. I need a good hunt. I scratch the door to get outside and chase birds, but the male says, "Suppose she gets wet. Won't the chassis get rusty?"

"She's supposed to be durable. The fur is drip-dry. We're supposed to wash her once a week, or whenever she gets dirty.

Like a dog. As if I couldn't keep myself clean.

But they won't let me out.

One day, from across the room, I watch a cardinal throw itself stupidly against the glass. The impact stuns it, but it flaps up and does it again. And again. Bastet gave birds wings to compensate for their incredible lack of intellect. But this cardinal (a male) clearly is so stupid it should be prevented from siring chicks. I know there is glass between me and that feather-brain, but somehow—is it because my female slave had the windows washed yesterday?—I forget there is a pane between me and the silly morsel.

I retreat a dozen paces from the window, turn, then crouch, stock still. I wait until the bird recovers from its latest collision. From a distance, I focus my whole being on that scarlet flash. I waggle my hindquarters, and I launch.

The glass shatters against my nose, and I seize the peabrained mouthful. It squawks and flutters. Feathers brilliant as blood fly around me. Ecstasy!

I pad to the porch and lie down to disassemble my treasure. The guts are slick and long, and I pull them eagerly from the twitching body.

But I'm not hungry. I remember the smell of bird blood, juicy and hot, but this bird is tasteless and without aroma.

I can, of course, use it as a hostess gift to my slaves, in recompense for their recent acts of service, and maybe get them to love me again, too. So, bearing the bright treasure in my mouth, I leap back through the window, avoiding glittering shards that might damage my fur.

It happens that the female slave is home alone, gazing mindlessly at a heap of paper in her lap. I land beside her, and she screams.

I've heard her scream before when I bring her gifts, and I attribute her shrieks to excessive excitement. After all, she could never actually catch a bird as I can, and she never gets really fresh meat. Her mate and she sometimes bring stale, cold meat into the house and eat it. And then there's the matter of the somewhat rotten cooked meat that comes in the little cans.

"Bad! Bad kitty!" she screams.

Then it dawns on me. She is upset that I have broken the window.

But it is my house. How can she object?

When the male comes home, the two of them call a dirty-looking man in coveralls to put in a new pane of glass. I see cat and dog hairs on the legs of his pants, but sniff as I can, I can't detect their odors.

"I think we should let her out," says my male slave.

The female says nothing. She just opens the door. I look at the open door. It is bad to let your humans believe that they can control when you come and go, but the autumn sunshine lures me. I saunter out.

And I stay out. I chase leaves and birds and chipmunks and a dog. The dog is a

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bully of a German Shepherd who belongs to the older of the two screaming women next door. It used to snarl and bar my way when I was weaker.

It barks at me once. When I puff out my fur, it crouches down menacingly and growls.

So I leap on it and bury my teeth in its snout.

It twists and tries to roll me off, but I am clever and strong, and I hold on. I ride it halfway into its own backyard before I become bored with it and let it go.

It is way too big to eat.

No, I am not really tired tonight. I never seem to tire since I recovered from my illness. But I grow curious about my humans. And also perhaps lonely.

So I climb the tree outside my humans' window. I know that tree goes to their window. I can see it every night from their bed, and there is a little red Frisbee that someone has thrown up and which is stuck in it. So it is easy to find.

I wait until they come in and take off their outer skins, as humans do. It always seems curious that they have these extra skins, and I like very much to smell them and then perhaps settle down and sleep on them. They lie in the bed and wrestle for awhile, the kind of wrestling that I think has something to do with mating, only there are never any kittens, so I don't know. Perhaps their previous cat had them fixed.

After, the male says, "We should let the cat in."

"I don't know. She hasn't tried to get back in. Maybe she ran away."

"You sound as if you—wanted her to run away."

"Bob, there's something spooky about that thing. It isn't Nefertiti. It's—a thing. A monster."

"Now you're making her into something out of a Frankenstein movie. But Honey, it's just a cat. A cat with an artificial body, and a personality just like our cat. To all intents and purposes, it's Nefertiti. Our cat, only younger and stronger."

"It's the 'stronger' that bothers me. When she went through that window today, I thought what she could do to us, if she got angry at us."

"You saw the *Today's Consumer* article. They don't attack humans, because the personality matrices they're built on—the old cat—is submissive. They see us as alpha animals. There has never been a case of a robotic cat attacking its master, and how many of them have been sold?"

"But I notice you agreed when I suggested she sleep outside with the dog."

"Go to sleep. You need time to reestablish the bond, that's all. Nefertiti still loves us, but maybe you need a little time to learn to love her. Again."

They are quiet for awhile. I feel dismal, as if I am sick all over again, only the sickness is inside my breast.

The humans do not love me. How will I survive if my slaves do not love me?

The woman makes little rustling noises, pulling the bedspread around her. "Suppose," she says, "there's a defect in our cat's chassis?"

"A defect? She acts just like Nefertiti did."

"Except stronger. She's stronger than a normal cat. The brochure didn't mention that, and neither did the vet."

"You think that's a defect?"

"I suppose I'm imagining things. Everything looks worse at night."

I crouch in the tree, watching the night pass. The shadows of the new Moon cast leaf shapes, and I feel cold in my heart, and alone. I think of crying out, of meowling, as I did when I was a kitten. Then the slaves would come and pet me. Once when I was a kitten, I climbed up in this tree, and they got a ladder and fetched me down, and caressed my fur and said how silky and elegant I was.

But I can't, don't want to meowl.

Everything looks worse at night.

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* * *

I fall nearly asleep on the tree branch, but something wakes me. The older woman next door screams, "Get out of my house, you filthy whore! You aren't my daughter any more. You can spend the night in the street for all of me." And the sound of a slap.

The other woman says, "Please, Mama. I'm sorry. I'll get another job."

I scurry down the tree and see the door open: a little shaft of light, then darkness. But someone is sitting on the back steps of the house next door.

I steal soundlessly across the grass and slink against her thigh. She raises her head and looks at me with red, swollen eyes. My female slave had such eyes when she took me to the bad doctor that last time. "You're a pretty thing, aren't you?" she says. Her hand glides over my back fur. "What's your name? My name is Gretchen. I wish I could have a cat. But how would I pay for cat litter and cat food, and the vet?"

I rub against her, basking in the PLEASURE.

She pets me for a long time, and I see her face is more peaceful. I can read human faces; it is an art I learned from my mother. I lean against her, and she lifts me into her lap.

"You're heavy! And you feel—I don't know, lumpy. You look like a Siamese, but what kind of cat are you, really?"

She talks too much. Maybe the other woman won't let her talk in the house, so she talks to me.

I curl in her lap and purr. She is not my slave, but she will do, because she is warm and soft and babbles soothingly.

But the older woman throws open the door and light streams out on us. "Get in here and finish ironing these sheets! My bed isn't made, and I have to get up at eight!"

"I thought you—"

"Make up my bed first. And do the dishes. You think we have a dishwasher, like rich people?"

"I'm sorry," says Gretchen. *I'm sorry* is her most frequent call, like a meow. She turns again to me, reluctant to let me go. "My mother won't let me have a cat. I'm going to have a baby, and she says I can't have a cat and a baby both. But she wouldn't let me have a cat before I got pregnant, either. So, I'll see you around, pretty kitty." And she is gone.

I go back to my house and scratch on the door to my house. Nobody answers, so I climb the tree and meow.

My slaves are in the bedroom, and they wake up. "It's her. I'll go down and let her in."

"You sound as if you don't want to."

"What can we do? I can't let it stay out all night. It's got feelings, if we are to believe the brochure."

"We don't have to keep it. We could take it back, get it deactivated."

"Oh, just like we euthanized her before."

"Well, you sound as if that's what you want. What *are* you thinking?"

"I think Nefertiti is really dead. This isn't her."

"So we should take it back. I can't think of asking for our money back—it would be like blood money."

She sighs. "No, we can't do that. But I can't connect with this—thing. It seems—mechanical."

"Well, sure. It is mechanical. A clockwork cat."

"I'll go down and let it in. It must suffer, in its way."

What does *euthanized* mean? Take it back? They mean me?

I run. My legs are long, strong. I can last forever. I do not need food. I am unafraid of dogs and bigger cats.

And I live in the weeds, under porches, and in flower gardens, for a long time. The days and nights come and go. It gets cold at night, and even in the daytime.

I miss my slaves. Nobody pets me, except children sometimes, and old humans who see me on the street. I sleep

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on empty porches in patches of sun, and I watch. I was stupid when I was sick, and before that, too. Before I became strong. I think I am what they call a robot. But I was once Nefertiti, and I have something in me that wants love. It is more than the need for the PLEASURE of touch. I want a slave to be mine. A human.

So I go back to my house, where my slaves live. I climb the tree and look in the half-open window.

In the exact center of their bed is a small white kitten. It is licking itself. When I hiss at it, it sees me through the window and freezes, then jumps down and flees.

As I watch, my female slave comes back into the room. She has retrieved the white kitten and is stroking it. Its eyes are half-closed. It thinks it owns her.

I watch, furious and stricken, for a long time. Then I go down the tree and slink into a bush. The German Shepherd comes nosing after me, but I hiss, and it trots away.

The neighbor human I saw before, Gretchen, is huddled, shivering, on her back steps. She gets up and ambles over to me. I see that she is fat, in the way of females who are about to drop young. "Hi, pretty kitty. I thought you belonged to the neighbors. May I pet you?" And she strokes me and strokes me and the PLEASURE rolls into my body like a wave of heat. I purr and rub frantically against her. "You're a stray, aren't you? Look, your fur is all full of burrs." She picks a few of them out.

"I wish you could come and live with me. But my mother would kill you. Sometimes I'm afraid that she'll kill me. Or my baby. My husband went away. He was going to be my husband. We're too young to get married. I think his parents sent him to military school."

I listen to her chatter. Her words mean very little to me, except that she is sad, and the older woman hits her. I know this, because her eye is bruised now, all purple. I saw this once when my male slave came home wounded. Another male hid in a dark place and pounced on him, then took his money. Money is very valuable to humans, and they will hurt each other for it.

"I wish you could live with me. But she'd say you cost too much to take care of." She sighs. "If her dinner isn't ready when she comes home, I'm in deep shit. Especially if she's had one for the road. So, stay out there, kitty."

She puts me down, and I mewl a tiny protest, but she is firm. She closes the screen door and looks through it at me. It's getting cold, these days, and she closes the door and goes inside.

She could keep me forever, and I'd never want anything except to be petted. My insides hurt, not with physical pain, but with a wanting and needing for the PLEASURE and for something else: for a slave. For love.

Gretchen didn't quite snick shut her screen door, and I pull it toward me. I'm stronger than that white kitten my slaves have brought into my house. I can open doors. Even doors to the neighbor's house, where I have never been.

The main door is harder. I think and think, and remember that humans do something with the knob. I stretch up and put my paws on either side. I press my paws together so the door knob is caught between them.

Nothing happens.

I remember: you turn it somehow.

The door unlatches with a click, then creaks open. Just a crack. Big enough for a big Siamese cat. My whiskers just brush the door and the jamb, on either side.

I scurry into the house. There are stairs. Upstairs was a good place, in my other house, the only house I know. Upstairs has closets, places to hide. I can hide for a long time.

I find a closet. If I could smell, I suppose it would smell of perfume and sweat and shoe leather. I leap to the dresser, then to the top shelf, and hud-

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dle behind a box of sweaters.

I sleep, but my mind listens.

A car grumbles up the drive, stops. The car door slams. "Why is this door standing half open?" The voice of the older woman.

The younger one, Gretchen, says something soft, appeasing.

"You think I'm drunk, don't you? You left the door open, you wasted a hundred dollars in heating oil. Pay attention! I'm your mother, not some mollycoddle teacher you can put one over on."

They argue. The girl sounds frightened. The mother is working up herself up to a rage. She is a dominant animal who snaps and rages and hits and claws. The younger one, Gretchen, is too submissive. Gretchen needs lessons in scratching back.

I wait. There will be sunny, soft places to sleep in this house. There will be cat food, though I will not actually eat it. There will be petting and purring, and I will sleep on the bed with Gretchen, and she will be my slave. There will be catnip. The word *catnip* in my mind lacks the fragrance I relish, but sooner or later, Gretchen will say, "catnip," and life will be complete.

Meantime, I wait for the mother to come upstairs. If she kicks me, she will regret it. ■

IN TIMES TO COME

Our lead novella for November is "Navajo Moon-Bird," by Fran Van Cleave, a near-future space-development story with an unusual perspective. As space opens up to private enterprise, who would want to move into that niche—and why? Some of the answers may seem obvious, but others considerably less so. The special requirements of space exploration may be a surprisingly natural fit for certain cultures that outsiders would seldom think to associate with them. Fran Van Cleave isn't exactly an outsider, having lived and worked among the people she writes about, and that background undoubtedly helps her see things that would not occur to those who've spent all their time *either* inside or outside.

We'll also have what I suspect is Rick Shelley's last novelette, a new entry in James Gunn's "Gift from the Stars" series, a quasi-historical incident (might it even be true?) by Sean McMullen, and seasonal tidbits from Linda J. Dunn and Michael A. Burstein. George W. Harper, an occasional but always intriguing *Analog* regular for many years, supplies our science fact article, offering an unusual perspective on meteorites—including one observation about their possible origins that seems obvious when pointed out, but it hardly ever is. It may, in fact, be a Harper original.

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When you don't use something very often, you can forget you have it. . . .

Jake, Me, and the Zipper

Rajnar Vajra

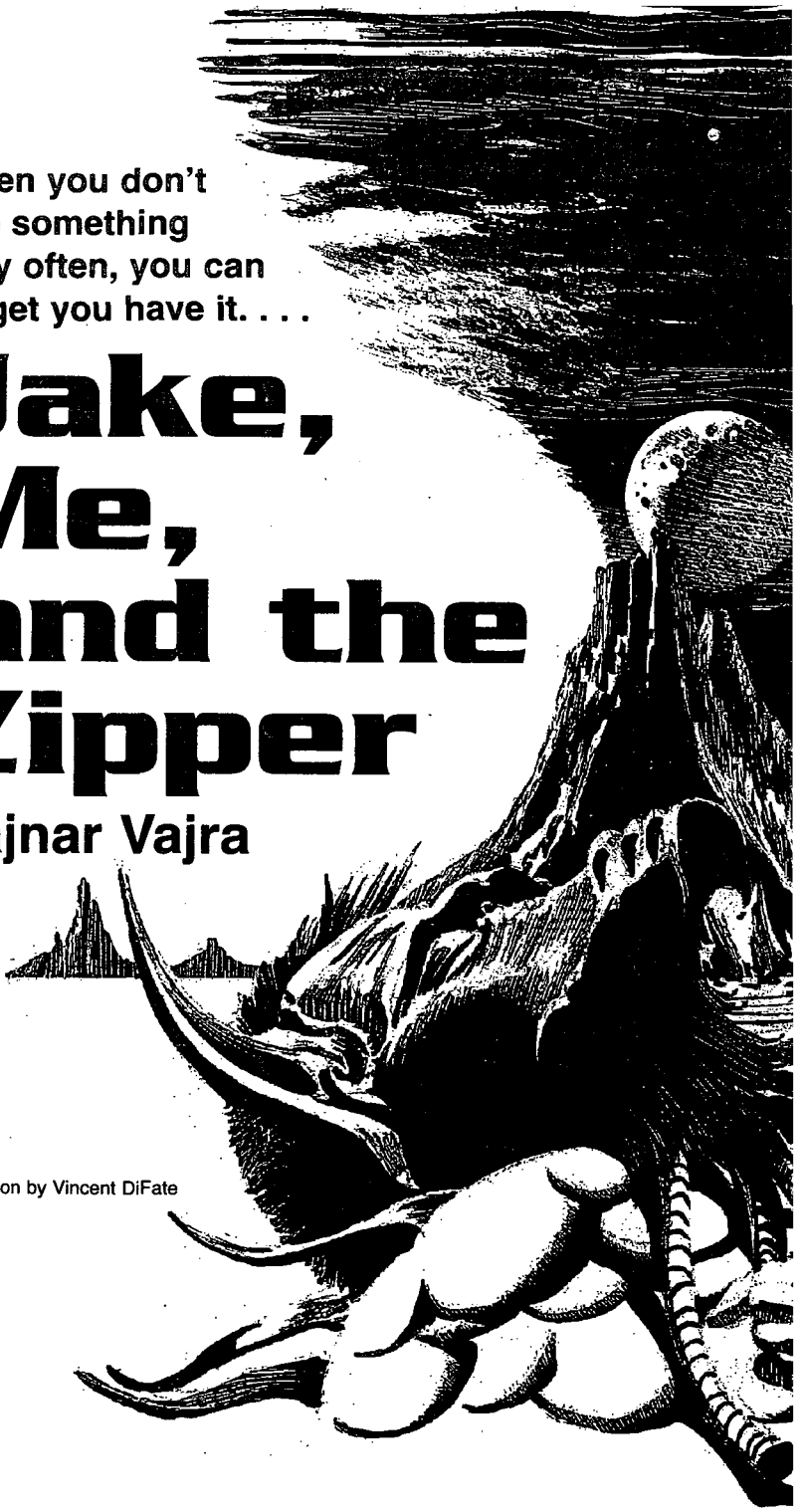

Illustration by Vincent DiFate

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Feyford City is always hot in early fall, but this was special. Jake, me, and the Zipper were practically melting on the sidewalk, squinting up at Gramma leaning out the window of her third story apartment.

"Ready, Hans?" she called as she does every school day.

"Ready as I'll ever be," I replied for about the millionth time.

"Here it comes. Bombs ahoy!"

Then she dropped a twisted piece of newspaper holding two half dollars, a quarter, and a decim. Enough to buy three boxes of Cha-gum candy. Last year, when I was eleven, we wouldn't have needed the decim.

"Run-amok inflation," Gramma calls it.

Today her aim was off, the bundle was going to hit Zip square on the head . . . He lowered his furry skull at the last moment and caught the paper neatly between his ears.

Wish *I* could do that! But the most we humans can do with our tiny ears is wiggle them.

Jake and I applauded and Gramma giggled. We kids gave her a goodbye wave (I blew a secret kiss), then headed toward Bunder's General, the nearest source of Cha-gum.

"First you pulp it, then you gulp it," I sang, improvising. Maybe I don't have the best voice in the world, but you should hear Jake's!

"First you chew it, then you blew it," Jake grumbled. He only ate Cha-gum to be sociable.

Candy, yum, said Zipper, but not out loud. The natives here on Fey's World (like Zip) don't use sound to talk. My dad says that Labiles speak "body-language" better than anyone in the galaxy and that humans get only a fraction of what they're saying.

He's wrong. I understand my adopted brother just fine, thank you. I've only grown up with him since pre-school!

A loud sniff startled me. Labiles are built for sniffs; six nostrils ring their piggy noses. Right now, Zip was testing the air and that made me nervous.

Nervous because this was Crazy Season, when solar flares make the Weather Service into a liar's club and everybody has to watch the sky for "clumping." No dark smudges were floating up there so I relaxed . . . about two percent.

Fundrastorms are no joke. You're dead if you can't get inside when a storm is coming. Dad says that dry air, fundra-spores, and solar flares are a bad mix. The spores are electrostatic and get superagitated in Crazy Season, attracting and repelling each other like "fickle magnets."

Once I saw a dog that hadn't made it to shelter. The poor thing looked like it'd lost a fight with a belt sander. I wouldn't care for that to happen to me or Jake, but with Zip around it wouldn't. Labiles evolved on this planet and can smell storms coming from miles away.

But today, Zip seemed worried about something lower than the sky. He kept sniffing and looking around. I glanced over at Jake and we both shrugged.

The owner of Bunder's General, Just Call Me Al, is one of those grown-ups who think that natives are stupid. Every time he talks to Zip he talks real slow. Gramma says the same thing happens on Earth: people who can't speak are considered morons. She says the word "dumb" used to mean someone who couldn't vocalize.

Just Call Me Al took our money and plopped our boxes on the counter.

"Here y'are, fellas," he boomed—guess he figures Labiles have trouble hearing. Zip waved an arm to say thank you, but I don't think the storekeeper got the message; some people are hard of seeing. I grabbed the goodies because I'm tallest.

Here was the deal: we wouldn't open the boxes yet but would walk to Jones Park and sit at our private bench if some-

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one else wasn't hogging it. We'd eat some sandwiches Dad had packed, and finally we'd dig into Cha-gum. While we chewed, we'd make various observations about the people walking past. When our candy was gone, break would be over. We'd have just enough time to walk back to school for afternoon class.

The operation called for split-second timing. And that's why I got mad when the boxes were empty and Zip still wouldn't move. He just sat there sniffing and wouldn't respond, not even when Jake and I started yelling.

"Maybe we'd better go without him," Jake finally suggested. Legally, Jake isn't part of my family (his last name is Snapes, not Hoffman) but he might as well be and Dad loves him as much as he loves anybody.

"No way," I explained patiently. "Dad would kill us if he knew we'd been wandering outside without Zip."

"Whatever you say, Hans. This way Teach can kill us instead! Come on Zippo, get it in gear. *Please?*"

"Zippo" didn't budge and I didn't know what to make of it. This day was already weird enough, even without Zip going on strike. Not only was it extra hot, it was also one of those mysterious holidays for adult Labiles.

Twice a month, like slow clockwork, grownup Labiles leave town. Gramma says they return to the "ancestral boroughs," or maybe she means burrows. Kids, even Labile kids, are never allowed to go along. Zip and I figure sex is involved, but Jake suspects sinister forces at work but he won't explain. I wish he would—he's got a great imagination.

The streets looked all wrong without any big natives and everyone felt it; grownup humans were staring at the sky way too much and they looked tense.

I glanced up again myself. Nothing but what Dad calls the "pink pearly heavens." Gramma, Dad, and Teach all claim that Earth's sky is blue and nobody's surprised to see stars at night!

Jake was trying to pull Zip off the bench with brute strength, which was ridiculous: Jake isn't much of a brute. Besides, Labiles look skinny and weak but they aren't, especially when it comes to their thick fingers. I've seen adult Labiles break *rocks* with their bare hands and Zip had one of his clamped to the bench. We weren't going anywhere until he was willing.

"Look, Hans!" Jake yelled suddenly, pointing at Zip's "snorkels," those long rubbery tubes that hang off a Labile's neck.

Zip has six snorkels. Dad calls them by some Latin name that starts with the letters "Pn" where "P" is just a parasite along for the ride. Everyone else calls them snorkels and their purpose was another mystery. The natives don't tell us everything. . . .

Labiles can breathe through the tubes but they seldom do. And their compound lungs have valves that allow air to flow out one snorkel while air flows in through another. Never run out of air that way. Gramma says this ability would be perfect for playing the French horn and it's a crying pity that Labiles hate music.

It was obvious why Jake was so excited; I'd never seen snorkels acting like this. Each one was rising up and wiggling around like a long worm looking for food . . .

"What's going on, Zip?" I asked, trying to act calm because Jake wasn't.

Zipper finally remembered that we existed. Something is wrong, he gestured.

"*What's* wrong?" Jake yelled and some nearby adults turned to look at us.

Don't know.

To my huge relief, Zip shot up and signaled us to start running. I forgot about the trash, but Zip never forgets to recycle. As we passed the bin, he pushed everything in at once.

We ran like the *fimbulwind*, but by the time we reached school, we were so hot we had to take turns slurping from

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the water fountain. So we wound up late for class after all. At least it was cooler inside.

Ms. Morsey, our sixth-grade teacher produced her patented look and waved us to our seats. Mr. Potts, Teach's assistant, shook his head as if he'd expected better of us. Mr. Potts is famous for supreme bad breath (Jake says it smells like Number Three). The Labile teacher, Mr. Polish, was gone for the holiday.

Class was in "joint session" with human and native kids mixed together. Normally, we have two hours of this every morning; but once or twice a month, depending on Labile holidays, we get a whole day of it. These are times I almost enjoy being in school. You'll see why.

Don't tell anyone, but I've picked up a habit of paying more attention to Mr. Polish (his official English name is Mr. Sixth) than to my own teacher. It's more interesting, trying to follow the Labile lessons even though a lot of it is about boring stuff like native history.

Real Labile names are movements, not sounds, but Mr. Polish got his nickname because he constantly rubs his desk with a soft cloth. There's a century-lamp behind his chair, and his desk has become so shiny that if you happen to be standing in the wrong spot, your eyes start watering from the reflection. Jake claims the desk is getting dangerous and is bound to cause blindness soon!

Zip says that Mr. Polish isn't bad . . . for a grownup. The Labile teacher in fourth grade used to smack her students with a flat rod if they stopped paying attention for a millisecond. And she always noticed! We called *her* "Ms. Bang."

I can't imagine how Labiles first managed to figure out human speech.

Here's what they taught us in third grade: An exploration Edgeship called *Molar* discovered Fey's World almost a hundred years ago. "Fey" was the name of *Molar's* captain and he must've been real modest to name a whole planet after himself. Anyway, when the survey team landed, they ran into friendly natives right away. Naturally the two species couldn't communicate.

The survey leaders were a married couple, Linda and Jeremy Jones. After weeks of study they announced that the natives (whom they called "Labiles" because of all the movements) were "intelligent, curious, and silent."

Duh.

They also claimed Labiles were "spot technological," which meant the locals knew about chemistry, medicine, weaving, and tunnel making, but didn't know mung-beans about superspace ships . . . or motors.

Working with pictures, the Joneses discovered that Labiles had never invented astronomy. Another duh. Here, you might be able to spot Rigel or Vega in the night sky once a month. Normally, our sky wears a mask of pink *rubelite* bacteria. (Rubelite also comes in colony forms: fibrous fundricula, and fundra. Fundra—fungus-tundra—only really thrives in extreme cold. That's why my world has pink icecaps.)

Evidently, the natives liked having nosy aliens poking around. When the Joneses went exploring, Labiles would tag along. And Linda and Jeremy got into a habit of talking to them the way people talk to babies who are too young to understand their own toes.

Six months after the Survey Team landed, the Joneses were having a picnic along with some natives. Supposedly Linda asked Jeremy to pass the salt and one of the Labiles got to the shaker first and handed it over.

So Linda tried an experiment. She declared that an open, raised hand meant "yes," and a closed, lowered hand meant "no." When she asked the group if they understood, every native raised an open hand.

That's why we celebrate "Picnic Day" every year although I vote we should call it "Pass the Salt Day."

Linda Jones spent the next decade try-

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ing to learn body-language and trying to teach locals to write. First she tried to get them to sign but the Labiles wouldn't; I guess Standard Sign Language is like baby talk to them. "Yes," "No," "Maybe," "Danger," and "I love you," were (and are) the only Standard gestures they'd use.

Linda learned a little body-language, but in ten years she only managed to teach one native to read and write. Dad calls this a "Phenomenal Achievement" but I don't see why. Ten years and one success?

Today, almost every native understands humans, but only the "literates" can truly communicate with adult humans.

At three o'clock, the class played Charades, which I'd been looking forward to. Of course, it was native kids who acted out the words and human ones who made the guesses.

Our class has eight young Labiles. In school they wear fundricula garments, half tunic and half jumpsuit. Gramma calls them "junics." Each kid wears his family colors (Zip's is purple because that's Dad's favorite) and the fabric looks like neolizard skin because it's scaly and shiny. Huddled around Mr. Potts (but not too close due to the Breath), the natives were a metal rainbow.

Potts whispered a phrase and the game was on. Labiles stood before the classroom display cases (the current exhibit was "leaves" from big Earth vegetables called "trees") and took turns playacting. This way our teachers expected us human kids to "hone our interpretive skills."

Honing shmoning, but on the days when the Labile teacher was absent, this game was fun!

You see, Ms. Morsey and Mr. Potts are pathetic when it comes to body-language. Anything but the most obvious gesture sails right over their heads. So during Charades, our native classmates could splice all sorts of remarks into their pantomimes. . . .

Dad says I'm depressingly bright for my age, but I would've had to be stupid not to guess the Charade instantly. Every kid in the room got the message, but none of us let on. All glittery in her gold, Three Thumbs used her neck and one hand to say "Rafting on Long River." Rafting is a great sport for those who think getting cold and wet and banged around equals a good time.

Labiles have double elbows on each arm. Three Thumb's right elbows said "facial protuberance," her left ones said "mining." One ear said "pleasure" and the other simply pointed at Ms. Morsey.

Meaning Teach likes to pick her nose!

Natives don't laugh out loud, but if you look real close, you can see their snorkels twitching. The Labiles were cracking up but neither teacher noticed. The rest of us had to bust a gut to keep a straight face.

The Chang twins are aces at this. Eventually, little tears come sneaking from the corners of their eyes, but otherwise you'd swear the girls were at their own funerals. Everyone has a technique. Jorge and Vicky try to remember sad stuff. Bobby Cox, a reformed bully whose skin is nearly as dark as Jake's, tries to get mad at something, doesn't matter what. The secret for me was *never* to look at Jake, who relied on lip-biting.

Jake was definitely the weak link, which is why Ms. Morsey suddenly said, "Perhaps you'd care to share the joke with us all, Jacob?"

"Sorry, Ms. Morsey. I . . . I was kind of thinking about something that happened over at Hans's house . . . yesterday."

This pitiful defense gave everyone an excuse to snicker, which was a relief. But Jake wasn't laughing. It wasn't the first time he'd gotten in trouble this way and now Teach looked ready to land on him with both feet. So Zip made a distraction.

While Teach was zeroing in on Jake,

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Zip kept Charading. His motions got real exaggerated as if the amazing thickness of our skulls was driving him crazy. Suddenly, he swept his arm way back, nearly overturning a bowl that held three *smoothies*. Smoothies are a small species of neolizard.

One specimen, Albert, made a getaway.

Neolizards are as slippery as they are quick. The room turned into a carnival as everyone hustled to recapture the beast. Smoothies can squeeze into the smallest spaces and the next ten minutes were more fun even than Charades. I wasn't so distracted that I missed Jake thanking Zip in our secret code, a human version of body-language.

Finally, Albert was back in his bowl and all was right with Fey's World. Teach looked annoyed but the moment to punish Jake had somehow passed. She merely whispered something in his ear and told us to proceed with the game. I don't know what Teach said, but Jake's big brown eyes got bigger.

Vicky Epstein made a supreme leap of intelligence and guessed that the answer to the Charade was "Rafting on Long River." Mr. Potts admitted as much and whispered the next phrase. . . .

The final half-hour of class was study hall and I used it to hone reading stuff upside-down; a talent like that might come in handy someday. I didn't glance at the clock more than once every ten seconds.

Finally I gave up reading and either stared at the clock, watching time pass in slow-motion, or looked out the window.

Most windows in Feyford City are merely rectangular holes in the walls. No glass or screens. After all, we have no nasty flying bugs that supposedly make Earth people miserable, and temperatures are usually comfortable indoors although today was a bad example. Our window frames have built-in "electro-grids" to keep out bacteria while letting in fresh air. When the weather finally does turn nippy or rainy, and especially during fundrastorms, a transparent sheet of super-tough plastic pops out of the walls, sealing the windows and doors. Our school has soffit air-vents with mechanical filters so that we don't asphyxiate.

Guess what! Just as the four o'clock bell *finally* rang, the weather klaxon sounded. Now we had to wait and hope for a false alarm. Exactly five minutes later, the stormwindows and stormdoors slammed shut automatically and we were stuck until the fundrastorm passed.

The storm-fringes weren't thick enough to blot out all light so I sat and stared outside. Purple clouds of spores were whipping around at incredible speeds. . . .

I knew when the power failed because of the loud silence you get whenever the air-cleaning system stops. It wouldn't kill us to breathe mechanically filtered air for awhile, but rubelite dust too fine for the filters was going to build up quick. At least we still had light; the century-lamps blazed away on backup batteries.

When the storm's heart finally reached us, the windows went black. I looked over at Zip and he was standing and sniffing. That surprised and scared me. I'd thought my brother was all finished with such weird behavior. Other Labiles were fidgety, which for a native means blinking a lot with their inner lids, but none were sniffing.

Jake was watching Zip too. I caught his eye and wondered if his stomach held a lump of dread as big as mine. Do you believe in hunches?

Then everyone jumped at some bright flashes and heavy booms. A growling rumble began building. Right outside the window appeared a crazy twisting lasso too bright to look at.

Loop lightning! You don't see *that* much. Dad says it's an optical illusion produced by thousands of small discharges following the circling winds.

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Fast-moving spores always build up more electricity than they know what to do with, but conditions have to be perfect for loop lightning.

I looked over at Zip. He wasn't interested in weather.

I can't remember the day Zip joined my family—I was too young. Wish I could, because Mom was alive then and I don't have enough years of her in my memory.

The natives, who raise kids semicommunally, suggested the idea. They couldn't get humans to understand some of their fundamental rules, like where not to build. With more and more humans on the planet, it looked like the old friendship between races might soon be over. Everyone hoped that if human and Labile children grew up together, it would blow a hole through the communication barrier.

Dad calls the adoption experiment "courageous," but Gramma says it was "desperate."

Zip's biological parents are dead (from some disease) and Dad is his legal guardian according to both species. Of course, when Mom and Dad volunteered, neither had expected Dad to be bringing up two kids mostly by himself.

Sure, the experiment worked, but sometimes it makes me sad to have to explain so much of what Zip is saying to Dad.

Ten long minutes later, the storm ended and power returned. The ion pumps made rubelite in the air clump up. Suddenly we had a private sky with little pink clouds wafting toward the air-cleaner intakes. Teach called Weather and announced we'd be safe if we got home within the next half-hour but we shouldn't dawdle. No sweat—I could crawl home that fast.

Teach pushed a button and the screens withdrew. Freedom!

Zip was in a rush to leave, which was fine with me. It was still too hot outside as we headed toward our apartment. Theoretically, Jake lives on Ainsworth Lane near the hospital, but there's a reason why my bedroom has three beds.

There are ten thousand people living in Feyford City and only a dozen medical doctors. Jake's parents are *busy*.

Two blocks from our apartment, Zip turned the wrong way.

"Hey!" Jake yelled. "Where you going?"

Zip slowed down just long enough to grab each of us by an arm so he could tow us along.

"What's with him?" Jake asked me.

"How should I know?"

The Zipper ignored us and sniffed as he dragged us toward the older, shorter part of town.

City buildings keep getting taller. They're even planning a skyscraper, thirty stories! Cheaper to build up than out, says Dad, because of "air-filtration efficiency." Gramma claims that Earth has billions of people and skyscrapers with over two hundred floors, but I doubt it. Bet you dollars to decims that's something they tell little kids. Like the story of the Eastern Bunny. . . .

I'd been daydreaming. I looked around and was surprised that we were already halfway down First Street. There was a commotion happening just ahead and Zip sped up, tugging us right into the middle. He stopped short in front of an old-town "duplex": a long, single-story structure with two separate apartments.

One apartment still had its emergency screens out. Weird! I'd never seen a stormwindow from the outside when the weather was warm, dry, and safe.

A short woman was having hysterics and four other grownups were crowded around the exterior control panel. They'd pulled off the protective covering and were punching buttons like mad but the window wasn't budging. I peered inside and got the fright of my life. The apartment was hazy, and float-

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ing in the haze were *ghosts!*

I stared numbly at a dozen gray specters until I noticed a little girl on the floor, apparently coughing her lungs out. She couldn't have been more than five years old and the coughing changed everything.

"Zip! Jake!" I cried. "There's a girl in there and the place is filling up with smoke." My companions ran to join me at the window so they could see too.

The apartment air-cleaner was working on the smoke, concentrating it into eerie shapes, but it couldn't keep up. The ghosts were growing.

"You smelled this, Zippo?" Jake asked, shaking his head.

"Couldn't have," I pointed out. "The place is sealed. These old units don't have soffit vents. Besides—" I lowered my voice, "You know Zip's been acting crazy since lunch."

"OK, Big Brain! Then how did he know?"

I had no answer to that, and no answer to the girl who'd noticed me and was mouthing something I couldn't hear. She was crying and I don't think I'd ever seen someone look so scared.

"Please!" screamed the hysterical woman, obviously the girl's mother. "For the love of God, someone just *break the screen!*"

But her idea was a bad joke. You don't break stormwindows. Not without a cannon.

A tiny lady who looked old enough to be Gramma's grandmother pointed this out and the mother sobbed even louder and asked "But why won't it open?"

"Try to collect yourself, Janet," the old lady answered. "You're not helping. That heavy storm must've screwed up your electricals. Don't worry, we'll get her out somehow."

This didn't appear likely at the moment. I wondered what was smoking so badly and why the mother had left her daughter alone in the apartment, but it seemed like a bad time to ask.

"Is there anything we can do?" I whispered to my companions.

Zip didn't answer directly. Instead, he used his snorkels in a surprising new way, whipping his neck around so fast the tubes started whistling. And within a minute Labile youngsters began showing up, some dragging confused human kids along.

It occurred to me that this might be why natives don't like music: certain sounds could be emergency alarms.

Zip got close to the window and signaled to the girl. That was smart since we couldn't shout through the barrier and had nothing to write with, even if she could read. But did she know body-language?

Obviously, she did. Zip gestured as slowly as he dared and she nodded now and then. From where I stood, I could only make out half of what Zip was saying.

There were now maybe thirty native kids on hand and Zip turned to them and gestured faster than even I could follow.

Twenty Labiles, all that would fit in front of the stormwindow, stood against it and used their powerful fingers to push sideways. They knew they had no chance to break the screen so they were apparently trying to push it back inside the wall.

They failed, of course, but amazingly they managed to open up a thin space at the end. Which seemed like a *bad* idea! If an actual fire was burning inside the apartment, this crack would feed it some nice fresh air.

I wasn't the only one worrying. Several natives that hadn't been on window-pushing detail had stripped off their junics and now they jumped forward to stuff the cloth into the crack, leaving only a small hole. Then Zip did something really surprising. He stuck one of his snorkels through the hole into the apartment.

I finally understood Zip's plan. The girl crawled to the window, stood up, and stuck the snorkel in her mouth. Jake

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whistled admiringly and I had to agree. This way, Zip could breathe through his mouth or one of his free snorkels and send the girl all the air she needed!

Soon, she stopped coughing. She squinched her eyes against the smoke and looked more peaceful although she was getting harder to see. Jake and I gave the Labiles and especially Zip a round of applause and some grownups joined in. Zip waved one arm in a graceful bow.

"Engineers will be here any minute," one man said to the mother. "They'll have *proper* tools. Lisa will be fine until then . . . thanks to our little heroes here."

From this, I gathered the smoke was from something smoldering and the apartment wasn't about to shoot up in flames.

Our moment of triumph was ruined because the weather klaxon went off. My mouth went dry. We now had five minutes to get indoors unless this was a false alarm. Surely it hadn't been half an hour since we left school?

Everyone's eyes turned upwards. Purple smudges were shooting across the sky.

Jake looked at me with dismay and my heart sank to the bottom. There was no way to stay outside during a fundrastorm. Zip would have to stop giving the little girl air and she would probably die. Everyone looked around urgently for engineers. But after serious storms, Feyford often has several emergencies; no saying when help would arrive.

Then Zip did something that scared me even more: he started shaking.

Labiles and humans breathe the same air and can eat many of the same foods like popcorn and Cha-gum. Scientists (including Dad) say that Fey's World and Earth are like twins. And living things on the two planets are put together similarly; we even get along pretty good. Sometimes it's hard to remember that Labiles aren't human.

I was remembering it now. Zip wasn't shaking like me when I've got the chills. Instead, he was trembling in sections as if waves of fear were washing slowly through his body. It was the strangest thing I'd ever seen, and yet I knew exactly what it meant.

Zip wanted to leave, wanted it bad, but he refused to go. So he stood there and shook and gestured for a few volunteers. Three very reluctant-looking natives stepped forward, slowly, and *they* started shaking.

I hadn't noticed until now, but more grownups had been arriving on the scene. At the fringes of the crowd, a familiar face appeared, looming high over everyone. Dad. I felt better instantly. Someone must have seen Jake or me or Zip here and called him at the lab. Without seeming to try, Dad pushed his way to where we were standing. He glanced at the apartment and understood the whole predicament.

"Ah, Hans. Hello, Jake. I take it there's someone inside?" Dad aimed the question at me with a raised eyebrow. The smoke had become a thick gray curtain.

"A little girl, Dad. Zip's giving her air."

I don't know if it's because Dad is so tall, because he's so smart, or because he's been on City Council for years, but whenever he talks, everyone listens.

That woman I'd figured was the mother hurried over. She'd stopped screaming but her face was pasty and when she talked she sounded like her mouth was full of novocaine.

"Councilor Hoffman?"

"Yes? I don't believe I've had the pleasure? . . ."

"I'm Janet Goulet. My poor little Lisa is trapped in there and the screen's stuck and a storm is coming. You've got to do something." The dullness of her voice was worse than screams.

"How did this happen?" Dad never rushed, even in a crisis.

"My husband was late for a meeting and he left without some important papers. So I stepped outside, just for a min-

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ute, to try to catch him. When I got back . . . the screens were shut."

"And the smoke?"

"I suppose . . . it started with my oven-mitt but my pot-roasts must be smoking by now, too. The power had failed in the storm and I was checking my roasts and I think I . . . left the mitt inside and forgot to turn off the oven. This is all my fault. My Lisa can't even reach the *controls* . . ." Her voice shot way up on the last word.

Dad put his hand comfortingly on her shoulder and thought hard for a second. "Ah! Is your oven-mitt made of fundricula?"

"I suppose so."

"That could explain it. When it started smoking, the window sensors interpreted the particulates as fundra-spores and concluded there was an ongoing storm." Dad was wasting his time doing biological research; he should have been a detective!

"But why won't the screen open from this side?"

"Because the sensors operate optically and with that much fundra near the window, even just on the inside, the locking mechanism maintains priority over the external panel. I'm afraid what we have here is a serious design flaw; I'm surprised this hasn't happened before."

"So what do we do?"

That's what I wanted to know. I'd never thought of pot-roasts or oven-mitts as dangerous but now they were going to kill a helpless child if Dad couldn't pull off a miracle. Maybe too much smoke of any kind is deadly . . .

"Janet, what *you* should do is seek shelter now," Dad said kindly. "I'll try to short out the sensors and get your daughter out. Meanwhile, I can think better with less of a crowd . . ."

This comment acted like magic: people started vanishing. Besides, everyone was getting anxious to be indoors. Almost everyone. Janet Goulet suddenly got hysterical again and it took four people to drag her away. As they did, she kept staring at the murky window as if she wanted to eat it with her eyes. I felt really bad for her.

Dad sure tried. He went to the outside panel, studied it carefully, muttered "my kingdom for some pliers," then ignored the buttons and started tugging on wires. Which didn't accomplish much except giving him a ugly cut on the thumb.

I tried to help. "The natives could pull those out, Dad!"

He was wrapping his hand in a handkerchief. "I know it, Hans. Unfortunately, their fingers are too thick to reach in far enough."

Dad returned to tugging and kept at it until he finally glanced at his watch. Not one wire had come loose. He sighed, looked around, and made a shooing motion to the remaining native kids who all ran off except for Zip's helpers. Each volunteer had somehow hooked up at least one of their snorkels to another volunteer's. I hadn't known they could do that!

The helpers surrounded my brother loosely, leaving him a few feet of clear space. As I watched, two kids attached a spare breathing tube to two of Zip's. What were they up to? Didn't they know what was coming?

Jake looked sick to his stomach, which I understood completely.

"Zip!" I yelled. "You can't stay here! You'll die and then Lisa will die anyway."

"I'm afraid Hans is right, Zippy." Dad still sounded calm. "Come away with us, we have only . . . two minutes left.

My brother's only response was grabbing onto the nearest wall. The other Labiles linked arms, making a solid barrier. All four gripped the textured sidewalk with their strong, bare toes.

"Zipper Hoffman, LET GO AT ONCE!" Dad had stuffed wads of sternness into his voice, but it didn't help.

By now I was so scared I couldn't think. I tried to shove natives out of the way and Jake did too. We might as well

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have been pushing on the window. Don't tell anyone, but I started to cry. I kept pushing anyway.

Dad had a smarter idea. He climbed right over the volunteers to reach the small space around Zip. Dad barely fit between the web of snorkels.

Zip is thin, even for a Labile. Gramma used to say that if he stood sideways and stuck his tongue out, he'd look like a zipper. Of course, Labiles don't have tongues, but the name stuck anyway.

But as skinny as Zip is, even Dad couldn't budge him. Dad must've been desperate because he tried to clobber Zip on the head with his fist, trying to knock him out I suppose.

But as the fist came down, it was slowed and then stopped by Zip's talented ears. Dad looked at me and Jake and seemed to come to a decision he didn't like. I knew I wasn't going to like it either.

"Boys, we'd better take cover."

"We can't just leave him here," Jake sobbed and I agreed with all my heart by nodding.

"I'm truly sorry, but what we can't do is stay outside any longer. I only hope that . . ."

Dad trailed off as he vaulted back over the wall of natives. He picked Jake and me up as if we were feathers and stared running down the street. Last I saw Zip, he was still shaking in that weird way. Maybe I was still crying too because everything looked blurry as Dad carried us to a nearby apartment and then inside.

Anyone's house is your house during a fundrastorm, that's the rule. Sometimes you get to meet interesting people that way. In fact, that's how my parents met Jake's parents and where would I be without Jake?

Dad put us down and I ran to the window, praying the storm would get deflected. When the screens slammed shut and purple clouds darkened the window, I stopped praying. Not only will storm-spores whip you to death, you can't even breathe.

It seemed like the longest fundrastorm in history but they say it only lasted fifteen minutes. We each waited it out in our own way. Jake couldn't keep still. He'd vibrate one leg at a time; I felt the floor shaking. Dad kept his eyes closed, but his lips moved as if he were arguing with someone.

As for me, I spent half the time with my nose against the window, trying to see through blackness. The other half, I watched Dad and Jake.

When the electricity went off, Dad said, "Well, at least that damned oven will cool down." The instant he stopped talking, the power returned and we all groaned.

When eternity was over and the storm finally ended, I was afraid to go outside. I kept remembering that dog. . . .

Dad was braver than me and Jake put together. The instant the screens withdrew, he was gone like a shot. We followed nervously.

We reached the smoky apartment and my stomach went into shock. The scene was even worse than I'd imagined. All the native kids were dead, lying on the ground, covered in thick dark red blood. Dad and Jake looked like I felt and I saw tears streaming down Dad's cheeks. I hadn't seen Dad cry since Mom died.

There was one miracle, but it brought me no joy.

The engineers were just arriving, which wasn't the miracle. What good could they do now? As far as I was concerned they might as well have stayed home. They ignored the bodies ("specialists" someone muttered darkly) and went right to the wall panel and started messing around. Suddenly, the screen opened and thick smoke poured into the street along with a very surprising sound.

Someone was coughing in there! Dad jumped through the opening and jumped back with little Lisa in his arms.

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How had she survived?

Lisa opened her eyes, coughed some more, and demonstrated that her lungs were fine by screaming for her mommy. And Janet Goulet came running and her glad cries almost drowned out the sound of Jake's sobs.

Dad stepped carefully over dead kids until he reached Zip. He bent down, touched the gore covering Zip's chest, and froze in place for a few seconds. Then he turned to us with a puzzled look on his face and showed us his open palm.

Clean hands—what could *that* mean?

Dad seemed to be asking himself the same question. But then he must have jumped to some startling conclusion because he whirled around fast and started tugging at Zip's face as if he were trying to pry off the goo. But it wouldn't come off. The stuff was apparently hard as stone.

More and more people were arriving. Then, in one of those rarest moments, the setting sun found a hole in the pink clouds and the street was suddenly blazing in scarlet.

Elongated shadows were bouncing on the apartment wall. I turned automatically to see what was casting such odd shadows.

The Labile elders had returned; a dozen were bounding toward the apartment, really moving, and leading the pack was Mr. Polish, Zip's teacher.

He danced through the crowd and put a gentle hand on Dad's back. Dad stood and the Labile took his place next to Zip's body. Mr. Polish's fingers were much stronger than Dad's. The teacher started working on Zip's chest first, breaking off chunks of the red stuff, but carefully, like a scientist uncovering prehistoric bones. As soon as the area was clear, the teacher started rubbing the spot with a figure-eight motion.

Nothing happened immediately, but I was dizzy with hope.

When Zip's leg twitched, a great cheer went up from every human watching, and Labile arms were raised and twisted in praise. Dad was grinning from one side of the planet to the other and Jake looked as if he might actually sing.

And I—I was perfectly willing to let Jake sing! If you'd ever heard him try, you'd know how happy I was.

Twenty minutes later, the four corpses were standing up on their own. Zip was scraped and bleeding some, but compared to being dead it was nothing.

Elders began asking questions. They talked with some Labile kids who hadn't belonged to Zip's team, then they tried to question the corpses. That didn't work; Zip and the others were still too groggy to make sense. So the Elders turned to me and Jake.

Mr. Polish took out his writing board and scribbled, "Please describe what happened here."

Didn't he know that Jake and I understood body-language?

We told the story, beginning from Zip's behavior in the park. For once, I felt a little important. When we were done, the teacher conferred with the other Elders and then wrote a longer message. He handed the board to Dad and Dad showed it to us.

Dear Dr. Hoffman, Hans, and Jacob,

These four children require medical attention including fluids and skin ointments. Do not be concerned, they will recover quickly. After you read this, please ask the engineers to use their vehicle to convey the children to Jones Hospital.

With your permission and his, we wish to test Zipper Hoffman when he is healthy. From what Hans and Jacob have told us, Zipper may possess a rare talent that may eventually qualify him for an important role among our people. The tests are in no way dangerous, but by tradition they must be conducted in the ancestral home. They should take no more than two weeks. When the results are certain, your son will, of

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course, be returned to you.

Yours in Fidelity and Hospitality,
Instructor Sixth (Mr. Polish)

This message was a shock. After what had happened, I didn't want Zip out of my sight. Also, I'd had no idea that the teacher knew we called him "Mr. Polish." Kind of embarrassing.

Dad, however, wasn't asking my opinion.

"Certainly, he may go if he chooses," Dad said agreeably. Right now, I'm thrilled to the marrow that my second son will be able to *make* choices."

Zip has been home for a week and life is finally almost normal. Jake and I tried to keep our routines going while he was gone, but it wasn't the same.

Dad has been cogitating, working out how the Labiles and Lisa survived. The Elders have even confirmed some of his ideas; for some reason, they've gotten more talkative recently.

Dad says he's beginning to understand the "design principles" of the Labile body. He thinks the natives evolved special instincts and abilities for survival in fundrastorm emergencies. We never knew this before, because we'd never seen a native stupid or desperate enough to brave deadly weather.

According to Dad, the four remained upright during the storm, their "aerodynamic" body shapes "minimizing spore impact." They only collapsed when the storm ended. The stuff that looked like blood was blood, but hardened from a chemical reaction with so much fundra. Dad says that he should have figured this out long ago. He says that Labile blood has no clotting agents and what makes it clot is stuff in the air: plain old rubellite, which is what fundra is made of!

Apparently, Labiles have also evolved a way to breathe during bad storms. They do it in groups. Natives hook some of their snorkels together and let other tubes blow in the wind. Since the tube-openings are always facing away from the wind (and the snorkels themselves filter some of the spores), there are brief opportunities to take in air. And with four or five natives hooked together, any air taken in by one can be shared with the group. But Labiles can't be huffing and puffing meanwhile, that way everyone would suffocate. So they go into a kind of suspended animation.

The snorkels are flexible but very tough and they're coated with a dead, hairlike material. The alive parts, the muscles and capillaries, are on the inside. They do get abraded by spores, but so slowly they'd only start bleeding if the storm lasted for hours.

Lisa survived because she was getting air until the moment Zip's team collapsed.

To me, what's even more interesting is Zip's "rare talent." That's one subject the Elders remain vague about. Zip is even vaguer, but only because he just doesn't know.

Leave it to Dad to come up with a theory.

Dad thinks that Labiles use more than their noses to detect incoming trouble. Fundra-spores stick fairly close to a storm's center; there shouldn't be anything to smell until the last few minutes.

"Here's my crazy idea, boys," Dad said at dinner last night. "This planet has such dangerous but unpredictable weather that evolution has . . . encouraged an extra form of perception. If so, it's only natural that some Labiles would be far more perceptive than others . . ."

Like Zip?

Dad has a term for this "extra form of perception": *prescience*. Sensing the future. He claims it's a real word, but I haven't checked the dictionary yet so he could be pulling my leg. Anyway, I remember how Zip was sniffing on that horrible day and I think what Dad really means is that Zip "pre-scents." ■

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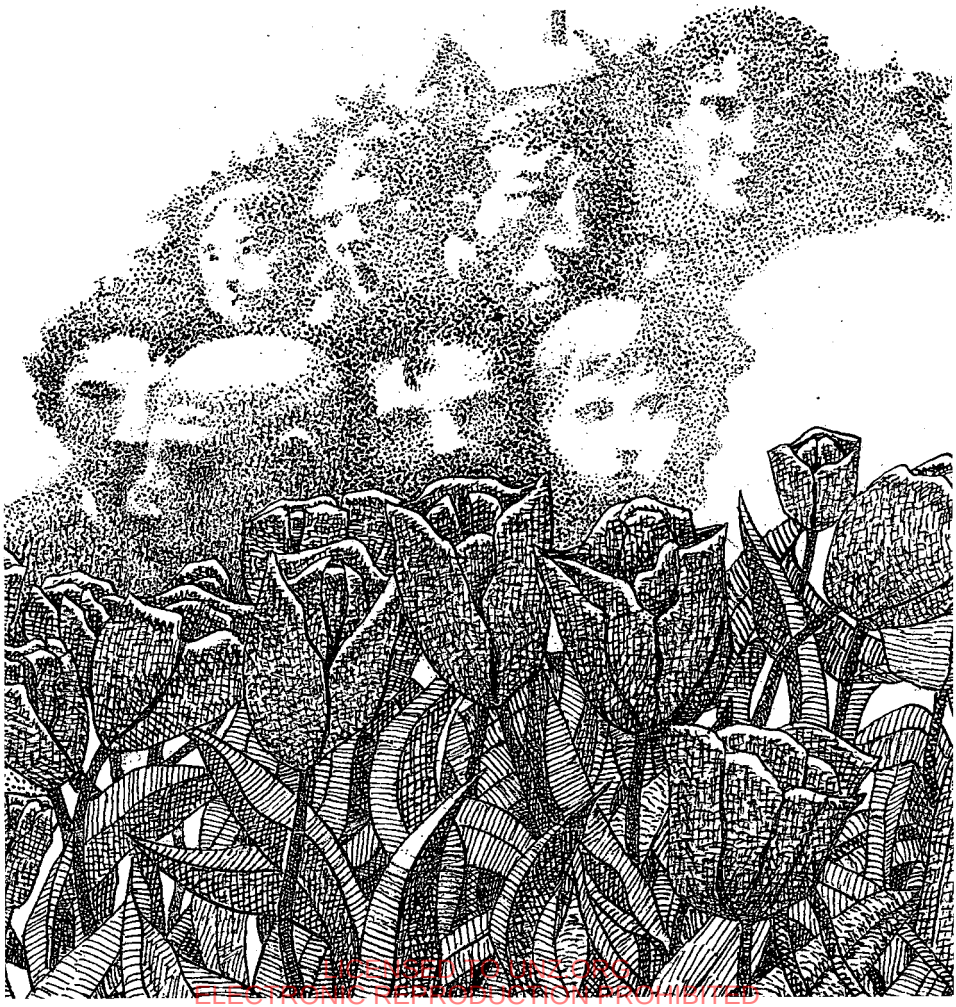
Sometimes what looked like an ultimate goal is just a beginning. . . .

The Return of Spring

Shane Tourtellotte

Illustration by Janet Aulisio



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Joe Dipano rode in the back of the ambulance, frowning. He didn't need this coddling. His daughter could drive him back home. Well, at least they weren't using the siren.

His nurse, Lucy Katz, sat next to him, taking his pulse. She was a sturdy, gray-haired woman, and not bad-looking. He saw her eyes fall on the patches on either side of his neck. She always worried that he would pick at them.

Stefanie was up front with the driver. She looked back now and again, always smiling. He smiled back this time, then frowned at something odd he saw.

"What happened to your ear, Stef?"

Stefanie turned around, nonplused. "What do you mean?"

"It looks swollen, and there's a red groove behind it."

Stef's hand reached, before she stopped it. "It's nothing, Dad. I've just been wearing something there too much."

"Oh. All right."

Soon they stopped in a familiar-looking place. Lucy helped guide him down the fold-out steps, steadying him when he tottered once. He walked toward the curb, shooting a last glance at the red-on-white *Essex County Geriatric Research Center* on the ambulance's side.

Stef came around the other side to join her father. "Welcome home, Daddy," she said.

Joe looked at his house. It was different somehow. He tried to place the changes—the paint, maybe, or the shrubbery along the walls—but it kept slipping away. Halfway to the front door, someone burst outside to break his concentration.

"Grandpa!"

A big hug nearly knocked the wind out of Joe. Lucy remonstrated, and Mike released him.

Yes, it was Mike. He had visited the hospital a few times in recent days. Joe recognized him: hair black like Stef and curly like Harry—but he had grown up so. Joe couldn't help smiling, though. "Good to see you again, sport."

Mike led everyone inside. Stef and Lucy turned right, toward the living room. "I want to go over the visitation and checkup schedule," he heard Lucy say. He started to follow them.

"This way, Grandpa." Mike had a hold on his shoulder. "I've got fresh coffee."

"They're talking about me," Joe said. "I ought to be there."

"I think they need to be alone. Please."

Joe snorted. "I wish people wouldn't treat me like a child. They say I'm cured—or would if they'd stop talking like doctors, trying to cover themselves every way they can."

They went to the kitchen the long way, through the dining room. The table had been pushed close to one corner, the chairs arrayed behind it in a protective huddle. "Where's the china cabinet?" Joe said. "It should be in that corner."

"Mom moved it," Mike said. "I forget where."

"I'll—" He turned, but Mike's firm grasp on his arm prevented anything more. "Fine. Coffee."

The kitchen was another surprise. Almost every appliance looked new, and most had black boxes smaller than his hand attached to them, near doors or control panels. Smaller versions clung to many drawers and cabinets.

Joe had an unsettling idea what they were. He nearly asked Mike, but he could imagine the pity the boy would have to cover up. He accepted the coffee mug Mike offered, taking a long swallow, noting Mike's watchful gaze. Joe didn't care for that, either.

"So, Mike, what have you been doing with yourself?"

Mike's smile faded to half-strength. "Well, I graduated college in thirty-one—"

"I know that! I mean since I saw you two days ago."

Mike flushed, but grinned. "Sorry. I've been visiting some old friends. . . ."

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Joe listened as he sipped. Did Mike think he didn't remember things he'd heard two days before?

Well, Mike was probably used to that state of affairs. He'd learn.

Lucy Katz walked with Joe to his bedroom. It was a weird sensation. Part of him knew his bedroom was on the second floor, that they were going to the den. Back at the hospital, though, they had told him Stef had moved his room to the first floor, and he had nebulous recollections of sleeping down here, too. It was like two pasts, two lives, overlapped in his mind.

Lucy wanted him to report any instances of disorientation. He might keep this one to himself.

The bedroom was his, all right. He recognized the dresser, though it was worse for wear, the drawers chipped and dented. The top of the dresser was covered with framed photographs, most of them decades old. Some of them looked banged up, too. He didn't see a mirror, but considering how decrepit he looked, that was a blessing. There were more of those black boxes, too, but he ignored them.

Lucy saw him looking at the photos. "Do you recognize them?" she asked. She picked up the closest one. "Who's in this one?"

Joe rolled his eyes. He knew when someone was giving him a mental exercise. "This is from college," he said. "I'm on the far left. That's Jerry Hafstedter, Javier Vega, Doug Payton, the one turned around is Tim L-L-Lassiter, and that's Nick Wechsel."

"And this?" She kept it up for a while, making notes on her clipboard screen in a way she thought was unobtrusive.

Joe did best with the old pictures. He nearly asked once why there was nothing with his wife, before remembering how long ago the divorce was. Newer photos were troublesome, but the hospital staff had filled in enough details of his life so he could get through them.

"That's Stef and her husband Harry in the middle. That's Mike, of course, and that's . . . I suppose it's Allie . . . but wait, Mike's married now, so maybe—"

"It's Alice," Lucy said, putting it back. "You did great, Joe. Let's move on to some physical exercises."

That was harder. He felt awfully weak, not surprising for how thin he was these days. He used the weights she carried in her bag, lifting and stretching until he ached. Then she tested his strength against the resistance of her own hands and arms. She was no youngster, but she was plenty strong.

"I keep feeling like we should leave the door open," Joe said with a grunt. "Or have a chaperone."

"Just keep pushing," Lucy said, not without good humor.

Joe managed to satisfy whatever criteria she had, and not too soon. "Bathroom," he said tightly.

"OK." She got her arm around his back. "This way. Through the door." They walked where she led.

"Must've knocked through a new door," Joe said. "This would be . . . the pantry through here. Stef really did change things around."

He opened the door, and again the duality of memories hit him. Strange, and fleetingly familiar. A closer look brought other, disturbing impressions. All the support bars and guard rails—and those boxes again. This was a bathroom for a cripple. Nobody would tell him so, but it was.

He caught a look at himself in the mirror over the sink, and nearly recoiled. He was close to skin and bones, his face pallid where it wasn't splotched red. What little hair had clung to the top of his head had faded to wispy white. He screwed his eyes shut and stepped back, his heel catching on the traction mat near the toilet.

"Maybe Stef can take all this hardware out," he said, "now that I'm better."

"The word is 'recovering,' Joe, not 'recovered.' You'll use these supports."

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"Do I have to do it with you here?" He didn't expect her to leave, and she didn't. She did turn away a bit, thank goodness, while he dropped his drawers, grabbed the long bars straddling the toilet, and settled himself down. He crossed his arms over his lap quickly.

"So," he said to divert attention, "how long will you be coming here?"

"Several weeks at least. A few hours a day, but that'll taper off as we go." She rolled out some toilet paper, to give her eyes somewhere else to go. "Of course, we'll have to bring you back to the center for weekly tests."

"In the ambulance, right?"

"Hey, it's perfect advertising for us, running that thing through town."

He chuckled at her joke. "You won't need advertising for long. Once word of this treatment gets out, you'll be beating patients away with sticks."

Lucy smiled a little. "No, let them all come. It's fine with us."

"Yeah." He stared ahead. "Me, too."

The nurse left before dinner, but Mike stayed to eat. Stef served a thick stew that filled the kitchen with hearty aromas before she could begin ladling. Joe noticed how finely the meat and vegetables were chopped, but that visual imperfection did nothing to the taste.

Joe had little to say, but Stef and her son kept conversation going. They would only flag a bit whenever Joe raised his spoon. Their voices weakened a bit; their faces froze a little; their eyes watched without exactly looking at him. Whatever calamity they expected, it never happened.

"I'll be back tomorrow morning," Mike said after dinner, "but then I have to head home to Michigan. Hopefully, next time I'm here, Kate will be with me." He left his grandfather with another big hug. Joe and Stefanie ended up in the living room. Joe kept waiting for Stef to say whatever she was struggling to get out, but she couldn't get past small talk.

Stefanie walked with Joe to the living room. "I . . . have some calls to make upstairs." She took the remote from a table in the corner—if the coffee table had still been around, it would have been there. "You'll be all right here, Dad, won't you?" she asked, handing it to him.

"Sure, Stef. Go ahead."

He cruised through the channels, with growing dismay. He found no hockey, too much basketball, and the baseball game didn't hold his attention. He found a news channel, which was worse. He concentrated on remembering a few names—the President's, for example—but soon couldn't stand the confusion of events without framework.

Joe clicked the Net access button, but found it locked out. He shut the television off and stood up, thankful this time for the bar next to the couch. She'd take care of this.

He reached the stairs. A black semicircular mat lay at the foot, and for some reason he hesitated to step onto it. It took an effort of will to cross that mat, but soon he was walking upstairs, slowly but steadily.

He heard Stef talking through an open doorway. A few steps closer, and he could hear someone else over a Netcomm. Both voices sounded awkward. Only when he heard Stef call him "Harry" did he know it was her husband.

Their call ended just as Joe reached the door and knocked. Stef gasped. "Sorry about that," he said. "Is Harry working late on something?"

"What?" She stood fast, nearly upending her chair. "Father, you shouldn't be moving around like this."

"It's my house." Stef flinched at his snapping, so he calmed down. "I managed the stairs fine, Stef. I've got my senses back . . . unless there's something you and the doctors aren't telling me."

"No! No, you're just still weak." She guided him out of her room. "Please, for my sake, take it easy. Tell me or Nurse Katz when you want to move around

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like this."

Joe groaned, but nodded. "OK, for your sake." He let Stef lead him back downstairs.

"Is there anything on disk you'd like to see?" she said once they were in the living room.

"Not really. What I want—" A stray memory nudged aside thoughts of the Net lockout. "You know what I'd love to see? The Winter Olympics from 1980. The U.S. hockey team. I was a freshman at Penn that year. My roommate, Nick, roped me into watching highlights of the first game, and from then on—honey?"

She was laughing, her face etched with bittersweet pain. "Oh, Dad, you've been fixated on that team for years. I got all of their games for you. They're in the shelf right next to the set."

His eyes grew. "For years, you say?" His mouth sagged. "I don't remember that." He watched her laughter subside. "You must be sick to death of those games."

"Completely," she said. "But I'll watch with you now."

He thought, then made a shooing gesture. "No, I'll watch them myself. You've suffered enough."

Stef seemed to wince, but the expression wasn't there long enough for Joe to be sure. She went to put a disk in the player, then gave him a kiss on the brow and went back upstairs.

Joe struggled a bit to watch until Baker's last-minute goal to tie the Swedes. The Americans were lucky: Sweden had great players, but lacked teamwork. Joe shut off the player and television, and leaned hard on the railing to stand up. He almost turned toward the stairs, then remembered where bed was.

He woke in the middle of the night to use the bathroom. Before he could close the door, Stefanie was there. She had a piece of molded plastic clipped to one ear, right where that red groove was. "Let me help you, Father," she said through a yawn.

"Oh, not you, too." He tried to argue, but his urges would not wait. He submitted to the intrusion.

Back in bed, with Stef upstairs again, Joe waited in vain for sleep. Harry, the earpiece, half a dozen other things nagged at him. Joe sat on the edge of the bed in his pajamas for a while. Something would help, but what?

Of course! A little reading to put him to sleep. That always worked.

It wouldn't this time. There were no books in his room, paper, electronic, or anything. He searched all the drawers, but the noise only brought Stef back.

He told her not to mind. Asking her would be too embarrassing. He'd get to sleep on his own tonight.

"Good day for a walk, isn't it?"

He and Lucy were on their eighth circuit of the house. There had always been a partial stone path, but now it was paved, and completely circled the house. Joe was starting to tire, but he wasn't going to show that.

Turning a back corner, Lucy gave a soft moan. "I could stand a rest. Let's use the bench here."

They sat side by side, close to the house, the whole backyard before them. Stef, or someone, had done serious work here. There were flowers of half a dozen varieties, each to its own plot, bursting forth in April brightness. Joe could identify violets, and probably pansies, but he looked in vain for something else.

"I always had tulips back here," he muttered. "Grew them after the divorce, because Laura hated them." He wheezed a laugh. "Also, they're almost the only flower I can recognize." He craned around, looking, despite Lucy's restrictive hands. "What happened to them?"

"I don't know," Lucy said cautiously. "You should ask your daughter. Well, look at that."

There was a birdbath centered in the

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plots of flowers, and a pair of sparrows had perched to drink. Joe's attention drifted from them, settling on the high wooden fence ringing the backyard. He wasn't going to ask anybody how that got there. He had too good an idea.

"I suppose you'll have me ask Stef about the earpiece, too."

Lucy looked at him, with a shade of a frown. "That's nothing secret. It's her house computer interface. The computer monitors the house, notifies her of anything amiss—"

"Like me," he said. "It snitches whenever I do something she thinks I shouldn't."

Lucy grimaced. "It's a common precaution for home caregivers. Joe, we told you your family had had to make adjustments to your illness."

"So why aren't they adjusting back? She still treats me like . . . like. . . ."

"It takes time, Joe, on both ends. She doesn't trust your abilities yet, and you don't recognize your weaknesses." She patted his shoulder. "Let's just look at the garden a while."

"No. You can't distract me that easily." Joe's hand began to shake. "That's what this garden was, right? Something to distract the old man whenever he has a demented tantrum. Calm him down, make him manageable, passive."

He hoisted himself to his feet, not even using a hand to push off. "I don't want to be passive. Been that way too long, another vegetable in the garden. And don't say whatever you were going to."

Lucy closed her mouth, and made her face professionally neutral.

Joe started shuffling, building up speed. "Let's get some more laps done, before I get stiff. No use sitting around."

"The President still acts the way he did before the midterm elections, and Congress is putting him in his place. The Welles administration is effectively over; the Democrats will—"

"Dad?"

Joe turned the sound down. "Morning, Stef."

"I heard the television," she said. "I thought you were watching the hockey again. Actually, I was worried you watched it all night."

"No, I'm trying to catch up on current events." He watched another commentator gesticulate. "They talk about the President, but it doesn't mean anything to me. I almost remember him being in Congress or something, for all that helps."

"You could look it up," Stef said, "to be sure."

"Can't." He lifted the remote. "I'm locked out of the Net."

"Oh, that's right." Joe had to hold the remote out to her for a moment before Stef took the next step and started undoing the lockout.

"A lot has happened," Joe went on. "I ought to buy those annual news summary disks I've seen advertised. I just wish I knew how many I'd need to buy."

"I can find you some history sites. There," she said, laying the remote beside him. "You can start after breakfast."

"Maybe I could bring breakfast down here—except—" He gestured to the carpet before him. "No coffee table."

Stef looked embarrassed. "It's in the basement," she said. "I put it there after . . ."

"After what?" Joe narrowed his eyes.

She glanced away for an instant. "You toppled over it two, three years ago, and fractured your wrist. That's when we started clearing away a lot of stuff, for safety's sake."

"Like the china cabinet?" he asked. "Or did I break that first?"

Stef flushed, and coughed. "I'll fix your breakfast now."

He ate in the kitchen, in an awkward silence. She had made the cereal too wet again. He said nothing. One difficulty at a time.

Search engines, plus his daughter's suggestions, brought him to several useful sites. He backed up ten years to

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2029, and began skimming. After a while, he went back another five years, and started over. This happened several times over, each time with a furtive glance at the doorway, and a growing fear of discovery.

He stopped at 2004, where he actually knew most of the events he was reviewing, and began his slow march forward. Many things came back to him as he read. Others he had to take on faith. The result of the election in 2008 was a shock to him—as was the assassination the next year. It felt like a lurid political novel more than history.

He kept studying, but his feeling of detachment grew. It didn't quite seem real, not even the events he recalled once his memory was jogged. Things that happened fifty years ago felt more real than events twenty years ago, or even yesterday.

Joe knew this was part of Alzheimer's: the reversion, almost like aging backward, shedding memories and abilities back to a second helpless infancy. He understood this on one level, but somewhere else, his brain would not submit to rationality.

His search began to wander, taking him back into the 1980s, back to the University of Pennsylvania. He knew the names, even without the photograph in front of him.

"Hello, Joe."

He jumped, and guiltily shut off the Net connection. "Lucy? You aren't due until this afternoon."

"It's half past twelve now," she said gingerly.

"Really? Was I working that long? I wouldn't have believed it."

Lucy sat next to him on the couch. "What's today's date, Joe?"

"Lucy, my memory's fine." She didn't budge. "OK. Sunday, April twenty-fourth, 2039."

"Where do I work?"

"Essex County Geriatric Research Center. I was there for thirty-one days, participating in a Phase Three test for an Alzheimer's cure. This patch," he said, pointing to his left carotid, "is a retroviral emulsion, composed to get past the blood-brain barrier. It reprograms the immune system to stop producing the impaired microglial cells that were poisoning my brain, killing it off. The one on the right reactivates genes that produce NR2B receptors, which boosts my memory so I recover my wits faster, so I can pass ridiculous tests like this."

He had drilled himself in the explanations the doctors gave him, almost from the start. Remembering those incantations, understanding them, had been his first sure sign that he was improving. They were his talismans against the darkness.

Lucy nodded, as she pulled cards from her bag. "Let's try another exercise, Joe. I'm going to read a series of numbers."

"I know how this works," he said testily. His pique did not prevent him from retaining and repeating digit strings as long as nine.

"Very good," Lucy finally said. "Let's get you some lunch, then perform some physical—whoa, let me help you."

Joe had tried to stand, but had fallen back heavily. "I'm stiff," he said. "Too long in one place."

Lucy got an arm around him, and guided him to his feet on his second attempt. "You certainly are. I can feel it all through your back. From now on, don't stay sitting so long, or find a more ergonomic seating arrangement."

Joe waggled his eyebrows. "I love it when you talk that way."

Lucy snorted, but he thought he heard a chuckle in there somewhere.

He wished he could say the neighborhood looked familiar, but it didn't. Still, this was Hazel Street, the other side of the block from his house. Maybe he hadn't gotten here much before.

The wind started picking up. Joe zipped his jacket higher. It wasn't good-looking, the faded tan spotted in several

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places, but it was the best he could find in the hall closet.

His slow gait carried him to the next corner, and he turned onto Pearson. Now things were more familiar. The peculiar two-part porch of the Costello house—or had they moved? The gray brick facing next door—had to be the same people: anyone else would have gotten rid of it.

He looked at the roof of one house. What was missing? Why did he think something should be there? Why—?

The sound of that question closed the connection. The Wylies! They had a forest of TV aerials on their roof, but no longer.

Well, no wonder. Joe knew enough about current technology to know that the television antenna went out years ago. Ten, or maybe fifteen.

Soon he turned the next corner, back home on Millwood. He felt like he could finish a second lap, but decided he had accomplished enough for today.

"Father?"

It was Stef shouting, and sounding alarmed. Joe saw her race out of the house, three doors away. He hobbled himself faster.

"Father!" She saw him, and came running.

"What happened, Stef? What's wrong?"

"You! Why are you out here? I thought you had eloped!"

"You thought I'd what?" He laughed. "Honey, you're taking my banter with Lucy way too seriously."

"No. That's a—a caretakers' term. Wandering away." Her fright had subsided, but she was still upset. "Where were you going?" she asked, with an effort at calm.

"Just around the block."

"Why?"

"Do I have to tell you everything?" From her look, it was plain she thought so. "I wanted the exercise. I'm sick of being weak and hollowed out." He gestured at his stomach, sunken under his ribs. "I would've waited for Lucy, but you can see these clouds building. Had to do it now. Tomorrow, I go back in for tests."

"But you scared me so—"

"Besides," he said before she could take over the conversation, "I wanted to get familiar with the neighborhood again, jog some memories—those few I've got left. That's not so bad an idea, is it?"

Stef's face began to melt into sympathy, but she held it off. "One of us should have gone with you."

"I wanted to do it myself."

"I know, but you have to talk to us. Please. For my peace of mind."

A familiar frustration welled up in Joe. "Fine," he grumbled, starting to walk toward the house. "Let's talk now, because I will go out again." He sighed. "It's time I reintroduced myself to the neighbors."

Lucy was also upset at his excursion, but got over it faster. She also convinced him, against his better judgment, to apologize to his daughter for frightening her with his disappearance.

He made his apology during dinner, another soft meal. Stef accepted it quietly, but obviously felt no relief. Joe could see that afterward, when he saw her with the earpiece she hadn't worn for a couple of days. The snitch had returned.

Joe spent most of the next day back at Essex Geriatric. The smells and glaring lights dug deep into his brain, triggering flight urges his thinking brain didn't understand. He admitted this to Lucy just before a cranial TRAP scan.

"You were badly agitated your first few days here," she said prosaically. "Maybe you're recalling those emotions."

"Oh," Joe breathed, and said nothing more. He was clothed for his scan, but lying on that table, with clamps holding his head immobile, he still felt naked.

The pokings and peerings and interrogations continued. Joe looked at the clock, expecting a couple of hours to

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have passed, and found only twenty-five minutes had. The pattern repeated itself half a dozen times before Doctor Dale made her appearance. She headed the test program at Essex: her benedictory presence meant all the real work was over.

Dale repeated, stiffly and precisely, all of the encouraging news he had heard piecemeal from a dozen people running a dozen tests. Then she added something new. "Your brain biochemistry shows a complete changeover to the benign microglial cells. We can safely discontinue that portion of your treatment. Ms. Katz?"

Lucy, who had been with him most of the way, peeled away the patch on his left carotid, and dropped it into a small plastic waste-bag. She had done that every three days for weeks, only to apply a fresh patch. Now, the skin stayed bare and cool, prickling a little.

"It's over?" Joe asked. "OK, I know it isn't, but . . . *it* shouldn't come back now?"

"We don't have long-term data," Dale said, "but projections are encouraging. At worst, we can resume treatment if symptoms recur." She divined a question from his look. "You will keep coming in for a while—for years, actually, though not as often. For today, though," she said with an unexpected twinkle, "it *is* over. We'll see you next week, Mister Dipano."

Lucy stayed with him on the ride home. He scarcely minded their using the ambulance again, save for some embarrassment at what the neighbors might think. Reminded of that, he asked Lucy about an excursion the next day, and got some positive noises.

Stef was midway through cooking when he walked in. He and Lucy told her some of the good news, before Lucy had to leave. Stef was pleased, and a gelatinous smile clung to her lips. She would not, though, consent to let him help with her preparations. Joe managed to bite off a resentful remark.

Dinner was excellent. The pot roast was juicy and almost flaked away at a touch. On the side were mashed potatoes and baby carrots, steamed to tenderness. Stef was still babying him, keeping his foods soft, but she made it easy to forgive the offense this time.

It did make him want to exert some influence on events, though. "How's Allie doing?" he asked midway through the meal.

"Fine," Stef said, rather hastily.

"OK. Then why hasn't she called?"

Stef remained cool. "She hasn't had the time, Father. She's been busy."

"The same way Harry's been busy?"

Stef put her fork down with a clack. "Alice's final exams are in a month. She has to study."

"Every minute?" he mumbled, not wanting a reply. "That doesn't explain your husband, either."

"Father," said Stef with tense patience, "you've been unaware of things for a long time. Things have changed, and you don't understand what's happened."

"I know that," he said with a grimace. "That's why I'm asking." His mouth hardened into a frown. "Have you two gotten divorced?"

Stef hesitated. "No. He's—oh, Father, please. Let's talk about this some other time. Not tonight. Not now."

Joe hadn't the heart to press on after that. He chewed at his pot roast, wondering when "some other time" would come.

The next day came soon enough, and the gray skies never took on the darkness of rain. Lucy carried an umbrella for insurance, but started the excursion promptly at two. Stef gave them a perfunctory send-off.

They walked next door. Joe took a long look at the mailbox by their door, "The Krols" written on it in brass letters. "Recognize the name?" Lucy prompted.

"Yes. Yes, I do." Joe rang the bell. "I just hope I recognize the faces."

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He was spared any moment of uncertainty. Eileen Krol could not have been happier to find him at her door, and Jason nearly matched her effusiveness. They invited Joe and Lucy in before either could speak.

They looked familiar, save for their age. They were in their fifties, near-contemporaries of Stef. Eileen even had the same incipient streaks of gray in her black hair as Stef. Their welcome tickled those ungraspable areas in his brain that had come to disturb him so.

The inside of their house tantalized him the same way, but one look at their kitchen sparked something close. "You still haven't remodeled here, after all this time."

He felt a moment of humiliation, afraid he had exposed some glaring fault in his memory. The Krols laughed. "Some things you never forget," Jason said good-naturedly. Joe smiled along, letting him think that.

Soon he was sitting at their kitchen table, being stuffed with tea, cookies, and muffins that Eileen seemed to produce out of the air. "We helped Stef out whenever we could," she said between servings. "Grocery shopping, other—emergencies. I wish we could have done more, especially after last year when—"

"Eileen," Jason said gently. Eileen put a hand to her mouth, while Joe dug for any memory of the Krols in his house.

"Of course, we heard about the treatments from Stef," Eileen said, regaining momentum. "We should have come over earlier."

"We were afraid of intruding," Jason added, "or of the cure not taking. Certainly seems to have. You haven't looked this good in years, Joe."

Joe shuddered. They were probably right. Ragged as he looked, he remembered seeing himself in hospital mirrors early in the treatments.

"How about you two?" he asked before he could shake again. "What's new in your lives?" He saw them trade nervous glances. "Don't try filling in the past. Just now."

They gladly did that, to such an extent that Joe and Lucy had to combine their efforts to extricate themselves. "I'm trying to meet all my neighbors today," he explained. "Can't stay too long anywhere."

The Krols took that in stride, releasing him with their best wishes for Stef, and promises to come help again if needed. By the time Lucy shut the door, Joe was almost dizzy.

"I guess that went well," he said. "Quick, next house before they pull us back in."

They went to the house on the corner. The doorbell set a baby to squalling inside. The crying got closer, until a young woman opened the door with the baby on her hip. "Yes?"

"Sorry to bother you. The name's Joe Dipano; this is—"

"I don't have time for religious proselytizing."

"No, I'm a neighbor. I live two doors down." The woman stopped closing her door. "I've . . . been sick for a long time. I'm reintroducing myself to my neighbors."

"Oh. I didn't know. We only moved in two years ago, last January. Were you looking for the Moloneys?"

Joe's eyes wandered away. "I suppose I was. Sorry to have intruded. Good day."

He was walking down the path even before she could close the door. "Stupid, stupid," he spat out softly.

"Would you like to go back home?" Lucy asked.

"No. I'm not quitting—but I hope the Woodses still live next door. Still got those ivied trellises. That's a good sign."

He waited a long while after ringing the bell. He almost left, but Lucy heard motion inside. Soon the door creaked open. An old woman peered out, and drew a sharp breath. "Joe?"

"Hello, Heather." What a feeling, to know her on sight.

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"Joe, what are you doing? Who is this—who are you?" she demanded, turning to his companion. Lucy introduced herself. "He shouldn't be out," Heather Woods said brusquely. "He's got Alzheimer's. He's—he's—"

"Heather, I'm better now." He reached for her hands, but she pulled them back. "They've got a treatment. I'll tell you all about it."

Heather Woods looked horrified. "When was this invented?" she croaked. "Why didn't anybody tell me?"

"It's still experimental," Joe said, starting to catch her anxiety. "I started treatments five weeks ago. Heather, what's wrong?"

She slapped his hand away, hard. "You had this all along! You knew he could be cured, but you kept pressuring me, and hectoring me, and I—I *gave in!* Oh, God!" Her knees buckled. She swayed against the wall, heaving with sobs.

Lucy jostled past Joe. "Ms. Woods, please calm down. I assure you, we—"

"Get out," she hissed, throwing her arm out to ward off Lucy. "Get out! I'll call the police! *Get out!*"

Joe stumbled backward at that last shriek. Lucy was there to steady him, and lead him out the door. He was too shocked to try to shrug her off.

Lucy fixed him coffee and toast in his kitchen, ignoring the feeding he had gotten from the Krols. She needed something to keep him there, while she talked to Stefanie in private.

Joe's hands shook too much to lift the mug. He spent a minute holding one hand over the other, stilling the tremors. That calmed him enough to take a drink of coffee and a bite of toast, before the shakes returned. He repeated the cycle over and over with grim resolve.

Stef came into the kitchen and sat beside him. He saw a transient movement in the doorway behind her. Was Lucy hiding close, or walking away?

He felt his daughter's hands clasp his. "I'm OK," he said, fighting to calm the residual shaking. "She rattled me, that's all."

"I know, I know." Stef lowered her head for a second, and kept her eyes tightened against some inner pain when she lifted it again. "I should have come with you, instead of Lucy. I know the neighbors. I know what's happened lately. I could have steered you away from her."

Joe looked intently at her. "What happened to John Woods? It sounded like he had Alzheimer's, too, but poor Heather was so hysterical—"

Stef nodded. "He did. It set in back in thirty-four, a couple of years after your diagnosis. His case progressed faster, though. The anti-inflammatory medications didn't slow it down. About eighteen months ago, Heather had to put him in one of the federal care centers."

She was the one trembling now. "Trouble is, they're overwhelmed; have been for years. The whole country's overwhelmed. The Senescence Boom. Our perpetual crisis; our Cold War against age."

"Couldn't she find a private home?" Joe asked. "Are they too costly?"

"There aren't any," she said flatly. "I mean, they were taken over, for maximum efficiency in coping." She muffled a moan. "If this is maximum. . . ."

Joe grew rigid and solemn. "So John died there. That's terrible."

Stef's eyes were feverish. She almost swallowed what came next. "It wasn't that simple. The staff kept making recommendations to her . . . polite at first, but they were hectoring her before long. She came to me once, begging for help, but what could I give her except words? She couldn't hold out forever. They're too insistent. Three months ago, she signed the forms—and they terminated his care."

The words struck Joe like a building roll of thunder. In his shock, he realized his hands were rock steady. Stef's weren't.

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"So Heather's outburst wasn't your fault," she said. "Something terrible happened, and she lashed out at you. You shouldn't have had to take that."

He made some acknowledging sound. The implications of Stef's tale were growing clear before him. He didn't want to face them all now. He'd tuck them away for later. Most of them.

Joe stood slowly, face turned away from his daughter. "While I was sick, Stef," he said, "did I . . . ever try to kill myself? I mean, did you ever think I wanted to die?"

"No. I—no, Father."

He made himself look at her. "You didn't sound sure. Maybe you think some fool accident I inflicted on myself could have been deliberate." He shook his head. "It wasn't."

"But—" Stef made herself say it. "How could you know? How could you remember?"

"I don't remember much. Flashes, impressions—" A shudder took him again. "Despair. Not that kind, Stef. Different. It was fatalism, thick like fog. I was done upon, not doing. My own actions couldn't help me. That's what I remember. So I don't think I would have tried something like that. I hope I didn't. After everything—"

He fell silent. They spent a long wordless moment composing themselves. Joe pursed his lips, as though purging a sourness, and said "Let's not talk about serious stuff any more today."

Stef chuckled nervously. "Fine with me, Father."

They said almost nothing during the dinner Stef reheated for them, and parted ways right afterward. Stef went upstairs to work at her computer. Joe watched his Boys of Winter in the living room. The Americans actually scored first in that game, the only time they did so in the whole Olympics. That was how much of a rout it was.

He switched it off after one period. There was something else he needed to do. Too bad Stef was using her computer. Her machine had the camera to make a video call, but she wasn't likely to permit it. Joe settled for the television and sound only.

He had dug up her number at Rutgers in his Internet studies, but had put off using it, diverted by Stef's warning. He was tired of waiting now, and he punched it in.

The phone rang three times before being answered. "Hello?"

Joe hesitated. "Is this Allie Stibornik?" he asked, galled that he couldn't tell.

"This is Alice." The voice turned uncertain. "Who is this?"

"It's your grandfather, Allie," he said. "It's Joe. It's . . . it's been a long time."

There was nothing for a few seconds. "Yes. Yes, it has. How are you? How are the treatments working?"

He told her in detail, more details than mere conversation required. He heard the guardedness, and he needed to get past it. "What about yourself?" he said after his jargon jag. "I know you've got exams, but I don't know what subjects."

She rattled off course names, still rather stiffly. "I'm majoring in economics," she added, something Joe had already figured out. "I knew that would be . . . useful."

"It certainly should be," Joe said. "I hope you'll have time after graduation to come back home. I wish I could remember the last time you visited, but I can't. Obvious reasons. When was it?"

There was another pause. "A while ago. Listen, Grandfather, I'm a month away from finals, and I have lots of studying. Could we talk another time?"

Joe grimaced but nodded; a pointless gesture without video. "Sure. Anytime, Allie."

"Alice," she hissed. "I'm not a child anymore."

"What was that?"

"I said I'm . . . glad you're better now."

"Thanks. We'll talk soon. Good-bye."

He toggled the phone off, feeling only a bit guilty. It was good to hear her

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voice, even in so awkward a conversation. Well, she had to be busy with schoolwork. He could remember what that was like.

Better than he could remember her.

Lucy's schedule switched, so she came in the morning. Joe waited until afternoon to resume history class, as he derisively called his refresher studies. He followed a routine Lucy suggested: fifty minutes browsing, ten minutes up and moving to prevent himself from petrifying on the sofa. It was like school all over: rigid periods, and a few minutes between classes. Joe chortled at the thought. Maybe he should be taking online classes.

His studies had reached the 2020s, the start of the Alzheimer's explosion. He read the maledictions of politicians, how they blamed his generation for ignoring in their youths what was to come, leaving the burden for others to carry. He felt curiously unprovoked. Was it because he expected politicians to be so nasty—or because they had a point?

He heard footfalls on the stairs. A moment later, Stef walked into the living room, looking stern. "Alice says you called her last night."

"That's right, Stef," he replied, gratified that he felt no twinge of shame.

"I told you she was busy."

"She's also my granddaughter. I should have some contact with her. Or was that what you were really trying to tell me—that she didn't want to hear from me?"

"Father, you don't understand."

"Don't talk down to me that way!" He saw his daughter's face, a twitch of pain presaging a shift into compassionate firmness. The sight struck him, on that vague subconscious level that he was learning to hate.

"Never mind," he said quickly, and struggled to his feet. He made for his bedroom, aiming for the bathroom beyond. He might get a few minutes of privacy there.

"Harry's coming over for dinner tonight," Stef said.

Joe looked around, carefully, hoping not to agitate her palpable unease. "All right, Stef."

"He's getting off the construction site a couple hours early, for once."

"OK. Good for him." He nearly turned back around, but could not resist one last word. "I'll set up the dishes tonight."

Stef opened her mouth, then seemed to decide she had said too much already. She left before Joe reached his bedroom door.

He got little more history reviewing done that afternoon, and his foray into more personal history did not hold his attention for long. He would have watched his West Germany hockey game, but he heard a car outside before he could reach the disk shelf. He switched off the TV, and headed out.

He reached the hall as Stef opened the door. Harry Stibornik's hair was grayer than in the photos Joe remembered, but his body was the same, broad and burly, gone a little to fat. She and Harry said hello, looked at each other, and hesitantly embraced. Joe moved on before they noticed him.

Murmurs reached him in the kitchen, while he searched for plates. Some cabinets and drawers still had those black boxes on them, but they opened without protest now, for Lucy's benefit rather than his. Anything breakable or hazardous was in there: plates and glasses, knives and forks. Joe tried not to dwell on that.

"Joe." Harry was there, standing a few feet away, extending his hand. Joe took it, feeling an incongruously delicate grip. Harry moved back a step, to stand aloof and appraising. "You're looking better," he finally said.

"I'm feeling much better," Joe said. "I'm in control of myself again."

"Of course." It continued that way for a few long minutes, a plodding conversational dance where neither man dared take more than the tiniest steps. It was a

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relief when Stef called Harry into the dining room, to help pull the good table back into place.

Joe went to the kitchen, finishing the task of getting the silverware out. He had the short stack of plates midway to the dining room when Harry met him. "I've got those," Harry said, snatching them from his hands before he could react and turning back to the dining room.

Joe's mouth fell open. He pointed after Harry, and began stammering at Stef, who had seen the incident.

"It's OK," she mouthed back. "You get the rest." She returned to the dining room. "I've got things on the stove. Can you help me watch them, Big Guy?"

Joe knew that didn't mean him. He walked back to continue his humble work, this time without usurpation. Stef and Harry worked at the stove, peeking under this lid, stirring that pot, and conducting their own conversational dance. Joe followed as much as he could while feigning disinterest.

That grew easier during dinner, a saucy pasta dish. He watched the looks, listened to the words, observed the brief clasping of hands. The more Joe saw, the less it made sense. You didn't stay willingly separate when such affections existed, not when you're as young as fifty-some like they were.

"Why the separation, Harry?" he asked rather casually, he thought.

Harry looked at Joe, then Stef, her expression frozen in alarm. "What have you told him?" Harry asked her.

"Only that you're not divorced," Joe said, "and that we should talk about it some other time. Well, time's here. I assume you're still at your house, Harry."

Harry ignored Stef's warning glance. "No. We sold that, end of '36. I have a small apartment in the city now. It's actually pretty convenient for most of my construction jobs."

"You . . ." Joe sensed danger in asking why. "So why didn't you both come here?"

"We did," Stef interjected. "We thought that would work best financially. I guess it did, but it was harder on us than we expected."

"That's an understatement," growled Harry, his eyes narrowing. "I've never had less sleep in my life."

"That's over now," Stef said soothingly. "It's best forgotten."

"No." Joe shook his head. "I'm sick to death of the hole in my life, of pretending it's not there, and I'm sick of being coddled. Go ahead, Harry. Speak your mind."

"Father," Stef whispered.

"Fine," said Harry. "The last years have been the most miserable of my life. Construction work by day wearing me down, then having to come home and take care of you while Stef worked retail at night. Both of us dead tired every day, and sleeping through the night was never guaranteed. We couldn't juggle everything forever—so we found another way."

"One that got you out of the way," Joe said.

"Father," Stef said, "that's unfair. Construction forepersons have more delimited hours, and better pay. He was the natural one to get relief. Besides," she added, "you're *my* father."

"It was no vacation," Harry continued, "for anyone. I moonlighted for extra money to send Stef. She learned freelance codewriting for something to do piecework, in the snatches of time she could spare from you. It might have been easier if we had worked from home from the start—but who was thinking of *this* back when we started our careers?"

Joe felt the heat of Harry's eyes. It was getting difficult to meet them. "You couldn't hire help? Someone to spell you now and again, once a week maybe?"

"Not exactly encouraged from on high. The federal centers are so much more efficient." He said it without apparent irony. "There are online advice sites and support groups, but not much

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else. The labor pool's not exactly flexible these days."

"You still came to help her, didn't you?" Joe said, less agitated now than before.

"Who do you think put in all the support bars and traction mats, the motion sensors and lockboxes, linked everything to the computer? Who took those tulips out of the backyard?"

"That was you! What danger were they? Did you think I was going to eat them?"

Harry locked his reply behind a prim half-smile, incongruous on his robust face. Joe felt the bottom drop from his stomach. His wordless appeal to Stef brought a pitying look. "Inappropriate behavior in Alzheimer's patients cannot be reliably predicted," she said, toneless as a computer recital.

Joe sagged, letting his chair back hold him up. He was starting to understand.

"We hid as many breakable things as we could," Harry said. "We never got everything, of course. We had to pay for whatever you did manage to break—like, on my skull."

Stef paled. "Harry, please. I think that's enough."

"No, honey, it isn't," he said coldly. "I stopped coming the last sixteen months he was sick. If he doesn't know he was raging at me like I was a burglar every time I walked through the door, he'll say I was abandoning you, and that's a lie!"

"He didn't mean it," Stef pleaded.

"I didn't," Joe echoed weakly, but Harry was talking again.

"Fine, but people can only take so much. It was tearing Mike up: thank God his wife got him away. And Alice—" He locked eyes on Joe, even as Stef clutched his arm hard in warning. "I can see you don't remember, Joe. Good. You don't want to know."

Joe felt himself drifting, and his trembling voice didn't seem like his own. "I told you, I have to know. No more shielding me."

Stef tried to interpose herself. "Harry, I forbid you—"

Harry sidestepped her. "He wants to know," he growled. "She always came to help out on college holidays, until you started mistaking her for Laura."

Joe groaned. His divorce had been nasty. "What did I throw at her?"

"Harry—"

"Yourself!" he shouted, as though swinging a scourge. "Seems you were pretty hot for Laura in the early days. Persistent, too." He grinned at the shock he saw. "Alice hasn't been home for over two years, for fear you'd get 'confused' again, and something worse might happen. I don't blame her a bit."

Stef started shouting at Harry, so neither of them heard Joe for a while, as he gasped out the word "Sorry" with each shuddering breath.

"Sorry?" Harry said, finally noticing. He looked back to Stef. "OK, maybe you're right. He's not to blame. I'm not saying he has to apologize."

He turned back to Joe. "I'm saying you *will* be grateful. People sacrificed and suffered for you—especially your daughter. If you're an ingrate to them—" The snarl on his face said everything. Joe trembled before it.

He snorted out his breath. "Too long." He headed to the front door. "Sorry about this, Stef. It was just too long to keep everything bottled up."

Stef glanced frantically between the two men, then chased Harry before he reached the door. Joe used the opportunity to leave the table, thankful nobody saw him slinking away, thankful nobody saw the tears begin to flow.

Joe walked slowly, the sky above leaden. Lucy matched his stride, and his silence. They circled the house methodically, a wordless understanding between them that they wouldn't be trying the neighbors again for a while.

A seam in the clouds produced a milky shaft of sunlight. A closed mouth muffled Joe's sigh, but he did mutter "Nice."

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"OK, that's the fourth word I've heard you speak today." If Lucy meant to provoke more, she failed. "I don't know what brought this on, but I expected it. It's quite normal."

"What is?"

Lucy smiled at the increased word count. "Depression. It's common in cases of recovery from long-term illness, for a variety of reasons. There's nothing shameful about it."

"I'm not depressed," Joe said, as the sunbeam vanished. "I just had a rough morning, looking things up on the Net."

"Must have been an early morning," Lucy said. "You look tired."

Joe looked away. "I've been looking up old friends. The ones in that photo on my dresser. You know the one."

"You've kept in touch that long?"

"No. Not for forty or fifty years, but my memories—well, that doesn't much matter. Finally finished the job this morning. Turns out Jerry, Doug and Tim are all dead. Nick, my old roommate—he's in an institution with Alzheimer's. Poor guy."

"I'm sorry."

Joe nodded. "I know. Only Javier is left. I'd call him, but I'm afraid he wouldn't remember me any more. Probably pointless anyway."

He was silent for half a circuit of the house. "The way my memory is, those fellows seem more real to me than my own family. Yeah, I knew they had changed, but that's easier to accept from a distance, when it's abstract. That's better than having the changes around you every day, getting them thrown in your face—"

"Like what?" Lucy probed.

"Nothing. Just an old man prattling."

"It's more than that. I saw Stef when I arrived. She looked as bad as you. What happened between you two last night?"

"It wasn't us." Joe looked at the empty birdbath they were passing. "Stef had her husband over for dinner last night. We exchanged words. Lots of them."

All those words came out. Joe's voice hardened with each sentence, revealing the facts, denying the emotions.

Lucy fought down her own reactions. "I'm sorry that happened, Joe, but I have to tell you, you were pushing Harry pretty hard."

"I had to. They thought I was too weak to hear the truth. No: too immature. Like a child." He laughed. "Second childhood is what they once called senility, so I'm rebelling like any teenager who's growing up faster than people realize."

"So Stef is playing the role of parent here?"

"Yeah—and I was frightful as a baby." His eyes dropped. "I didn't understand before what she went through, what everyone did. I thought the horrible stuff all happened to me. What they went through, I thought was like an annoyance you get used to, like having a bad back. More like a broken back."

He coughed, trying to clear his tightening throat. "I remember so little. It's like I slept through having Alzheimer's, with occasional nightmares." He looked at Lucy, his guard down. "They remember it all, the whole nightmare. All because of me."

"Joe, it's—"

"I know. I'm not to blame. Even Harry said so. But there's a responsibility, a debt I owe. Especially because they didn't have to carry the burden so long." He shook his head. "Why Stef didn't let the government care centers have me, I don't know."

Lucy ventured to put an arm around his shoulder. "I think you know why, Joe," she said, as they walked along.

Joe did know, but it took time to accept, time in solitude. He insisted on eating alone for a few days. Things always seemed to go bad when he and Stef ate together. Stef acceded, even letting him make his own dinner once without always hovering in the hallway outside.

He still studied history, though he had advanced far enough that he could start

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calling it current events. He let his search for old friends languish. Sixty years seemed a longer time than it had.

He abandoned his Olympic hockey for the same reason, just before the medal round. The Americans had won hockey gold again when the Olympics returned to Lake Placid in 2030. The surge of nostalgia probably explained how the 1980 disks got printed, and that made it seem all the more distant to Joe. Besides, the game against the Soviets was more joyful and glorious than suited his mood.

It was three nights after that disastrous dinner before he steeled himself to go to her bedroom. She looked up from the computer, thankfully not upset that he had dared to climb the stairs. He had to struggle to find the words, more upset at his faltering than Stef was.

"I'm not an ingrate," he finally said. "Maybe I'm slow catching up on things, but I am not unthankful. You took an enormous amount on yourself, keeping me out of the institutions, holding on and holding on."

He briefly went blank again. "I don't know whether people were talking about this cure. Did you know it was coming? Did that give you hope? Or was it pure stubbornness?"

That wrung a laugh out of Stef. "Stubbornness, I guess. Not all mine, though. You fought so hard early on to resist deterioration. Drug treatments, memory courses, physical therapy. Losing ground frustrated you terribly, until the disease took away your determination, too. I . . . had to live up to the standard you had set. I had to fight until I broke, or I couldn't have lived with myself afterward."

"I couldn't have lived, either. I've seen what happens, once you start down that slope." He swallowed. "You saved my life, Stef."

"Father . . ." She saw his arms open, and gave herself to them, trying not to shake with each breath.

"Tell everyone I'm sorry," Joe said, his voice trembling. "Tell them I'm grateful."

"They know, Dad. They know."

"Tell them anyway. Allie especially. Please."

Stef said nothing, just holding him. He quietly accepted both.

The revival in his spirits lasted nearly a day. Even with the skies clearing, and May turning warm and bright, he began to sink back into despondency. Something was still not right, and he knew not what.

Lucy was there for fewer hours now, but her ministrations had restored some of his physical strength. He could circle the block twice without getting winded—and without getting anybody upset at his 'elopement.' He could even kneel to attack a few weeds in the backyard, and stand with only the help of the fence or the house's back wall.

His growing bodily vitality should have helped. It didn't.

His slow return to normality with Stef, their ability to talk without creating a great emotional scene, should have helped. It didn't.

Regaining a measure of control over his life, with Stef no longer wearing the earpiece, and reversing her power of attorney, should have helped. It didn't.

Understanding news programs and Net articles, no longer feeling like a stranger to the present, should have helped. It didn't—and it went beyond the tenacious resentment of the old.

Lucy had predicted it, but given no curatives. Antidepressants might react unpredictably with the one gene therapy he was still taking, maybe even turning his microglial cells hostile again and restarting the disease. Nobody knew, and nobody cared to take chances. Depression was better than the feared alternatives, and Joe did not blame them.

He muddled along, filling his day with current events, NHL playoffs, and the occasional old movie off the disk rack. He made no complaints. Things could

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be much worse.

He awoke one morning with a groan that had nothing to do with a stiff back. The significance of May 12th had survived every assault his brain had made on itself. "Happy birthday," he croaked, before dragging himself to the bathroom.

Stef was more cheerful when she said it. He smiled, more from her kiss and the aroma of pancakes. They ate breakfast together without incident, then parted, she upstairs to work, he to the living room to follow his own lesser pursuits.

Nothing notable happened until two that afternoon. Stef answered the door by the time Joe got to the hallway. Their visitor surprised him. "You're early, Lucy," Stef said.

"Early, nothing," Joe said. "I thought Thursday was your day off now."

"It is," Lucy replied, walking inside, "and I'm spending part of it with the birthday boy." She planted a kiss on his cheek before he could react.

That didn't quite distract him. "Stef, how many other people have you put up to this?"

Stef smiled coyly. "Wait and see."

The wait was not long. An unfamiliar car pulled up next to Lucy's in the driveway, but the driver who got out was familiar. Joe met Mike on the doorstep with a hug, and a second one for his wife Kate, which she accepted coolly.

The Abrahams from next door arrived next. Before Joe could ask Stef about the other next-door neighbors, the Krols appeared, laden with enough plastic plates and bowls for a sizable buffet. "Feels good to chip in again," Eileen said before stepping out again for the second load.

Conversation was already filling the house when Harry arrived. Joe waited until Stef finished greeting him, then stepped forward, tentatively offering his hand. Harry took it, firmly this time.

"I'm sorry," said Harry, but not before Joe could start saying "Thank you." They both smiled, and let it rest at that.

If that was Stefanie's intent, Joe decided to make the most of it. He circulated among the guests, taking time with each to speak words of gratitude for all they had done in the past years. "This party's for you," he told the Krols, "as much as for me."

His rounds finished, Joe took a moment in a corner to reflect. He expected the weight of days past to lift, as came of discharging one's duty.

It wasn't happening. He still felt something, that old ghastly sensation of a half-memory tickling him where he couldn't reach it. That, and the slow deflation back into melancholy. Joe put a brave face on it, reentering the mix, but feeling like flotsam tossed on the waves.

"Enjoying yourself?" Stef asked.

"Yes," he replied, as reflexively as saying "Fine" to a "How are you?"

"I'm sorry Alice couldn't be here, but exams are next week." Joe nodded, more relieved than anything else. That was one confrontation he still dreaded. He had written her a long e-mail some days back, with Stef's knowledge. Nothing had returned.

He drifted from person to person, chatting with the neighbors, eating his buffet dinner with Mike and Kate, even talking to Harry. His son-in-law was offering to come over that weekend to help bring furniture out of the basement, and take down the surveillance equipment. Joe wasn't so far detached as to turn down the overture, but enough so to direct him to Stef.

"Well, I think she's busy at the moment," Harry said.

Before Joe could ask, he heard her. "Dad, come to the kitchen, quick!"

He and Harry arrived seconds before Jason Krol did, carrying the cake. Two huge numeral-shaped candles topped it, proclaiming his years with chemically enhanced blue flames.

The gathering broke into song, but Joe barely noticed. Seeing the '78' there started an avalanche within him. He understood now, and the knowledge

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brought not relief but renewed gloom.

He didn't remember blowing out the candles, or receiving the slice on his plate. He picked through half of it before it all became too much.

"Excuse me," he said, and the talking ceased. "I want to thank you all for coming, but I'm . . . I'm an old man, and my stamina isn't what it was. Please, keep enjoying yourselves, but I need to turn in."

He left his plate and walked away. Murmurs followed, but nothing else.

He headed straight to his bathroom, where he bent over the sink until the retching urge died down. He splashed water on his face, then caught a peripheral glimpse of himself in the mirror and shut his eyes tight. That face was the last thing he wanted to see now.

Lucy was in his bedroom when he emerged. She had her bag. "Oh, Lucy, please—"

"It's only a few routine tests, Joe."

He dodged her approach, slapping half-heartedly at her outstretched hand. "I'm fine."

"You said you were tired."

"I said what I had to." He sat on his bed. "To get away politely."

Lucy set down her bag. "All right." The question she didn't ask hovered between them.

Joe knew he couldn't resist forever, and this time, he didn't want to try. "Now what?" he said piteously.

Lucy tipped her head in puzzlement, letting silence draw him out again.

"I'm seventy-eight, Lucy. I'm an old man. I spend my days idle, except for filling the gaps in my memory. My past is so distant and disconnected, it's meaningless, and my present . . . equally meaningless. Is this what my cure brought me? Did I come out of darkness, just to mark time until it falls again?"

Lucy tried to look supportive. "It's your life, Joe. You can do with it whatever you like."

"Like play left wing for the Devils or Canadiens?"

"You know what I mean."

"But I can't do *anything*. I wouldn't know how to start doing my old job, and I'm nobody's recruitment dream. I'm not set for a luxurious retirement, either. I've seen my finances; having Alzheimer's bled them pretty well. Stef budgeted for a limited time span, and we were getting pretty close to the end." He shivered.

"Are you saying she's responsible?"

"No! She acted sensibly enough. She couldn't know. . . ." He shook his head. "Maybe I should have her train me in coding piecework. I could take over for her when she returns to Harry. She will soon enough, once she accepts that I can live on my own."

He looked at Lucy for confirmation, acknowledgment of his autonomy. He found enough.

"So what's ahead of me? Do I sit and look at the garden every day, and hope I don't have to sell the house? Do I do menial work to make ends meet? Do I depend on others? God, they must be as sick of that as I am. What do I do?" His head sank to his chest. "I don't know."

After a moment, Lucy sat next to him. "You'll think I'm crazy, but I have to congratulate you." His look confirmed her suspicion. "You're facing tough choices. Tough, everyday, mundane choices, the kind average people deal with all the time. If that is now the central fact of your life, I suggest you take a look at where you were two months ago, and see what a tremendous distance you've covered."

Thought began to replace some of the pain on Joe's face. "I think I agree with you," Lucy added. "It's time to call it a night, so I'm rested when I return in the morning." She stood, waited for a reaction, then patted him on the shoulder. "Good night, Joe."

"Good night." He let her leave without a glance or another word.

Stef and Mike peeked into the room later. If Lucy had recounted anything he

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had said, it didn't show. They didn't stay long, letting him get to bed.

Not to sleep, though.

Lucy was wrong. There was no normal life after Alzheimer's. It was like those memoirs he had read a long time ago, of soldiers in the Civil and World Wars. Their experiences transformed the landscape of their lives, cratering it as an exploding shell would. The imprints never left, no matter how long they lived.

"Touched with fire," one of those veterans had said of himself and others. Joe was seared. So was poor Nick Wechsel. Heather Wood, too, indirectly—and maybe directly. He had heard the Abrahams gossiping that her outbursts were a symptom, wondering if she had gotten an onset prognosis as so many had in this hyperaware era.

How many millions more burned in the fire? How many would this cure reach? Their minds might heal, but they would still carry dreadful wounds. Doctors would have no patches to slap on their necks to set those right.

Those horrid images stayed with him through a night of drowsing, a half-consciousness that paralleled his memories of the incoherence of Alzheimer's, doubling the torment. Pain and grief swirled and comingled, until he could not tell whose suffering he felt more.

He finally awoke to bright sunlight slanting through the window, herald of a late rising. He shook off his torpor in the bathroom, then went to the kitchen to find Mike and Kate finishing their breakfast. He gladly spent time with them, knowing they would leave soon to catch their flight home.

The idea that had coalesced during his restless night stayed in the back of his mind, needing no concentration to hold in place. He almost spilled it then, but managed to wait.

Lucy arrived soon after Mike left. Joe met her at the door, grinning. "Lucy, I've got a proposition for you." He saw her look of amused scolding. "Not that kind. Better."

The recitation of names and parade of graduates seemed to last forever. Some in the audience fidgeted in the hard seats of the stadium, the only place Rutgers had large enough to hold commencement. Joe Dipano sat serenely. He didn't mind letting time pass.

He did cheer heartily, along with Stef, Harry, and Mike, when Alice advanced to receive her diploma. He wished Lucy had come along—he was only realizing how attached he was to her—but the college was firm on its four-seat policy at graduation. Well, he'd get by.

The procession ended, the dean spoke, the caps flew, and the ceremony became a mob. Joe's group headed for the exit rather than the floor of the stadium, having arranged a less crowded rendezvous in advance. They moved against hundreds of jostling parents, and reached the pair of elms outside a few minutes before Alice did.

She hugged each of them in turn. Joe was last, and though Alice hesitated, it was the longest of them. They had had their talk the previous night, exorcised all the horror, restored that last ravaged connection in Joe's family.

Other robed graduates shouted to Alice in passing, and some walked over. Alice made introductions, with a special glow reserved for her grandfather. "He's unretiring," she told them, "to write a book."

"Co-write," Joe corrected. "I can't do it right without Lucy. She's the technical expert."

"What's it about?" a couple of Alice's friends asked.

"Alzheimer's." A chill fell. "Recovery from Alzheimer's, that is. From someone who knows."

Before he knew it, the graduates were peppering him with questions. Rumors of a treatment had leaked out in the last week. Hearing that it was true energized them beyond Joe's expectations. The burden of support was lifting from this

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generation, and they reacted like birds freed from their cages.

He didn't begrudge their excitement, but his concern was with his contemporaries, the millions for whom nightmarish hibernation would soon end. They would need help in adjusting to their second lives. Who better to help than one who had endured what they would: the yawning holes in their memories, the bodies still infirm, the caretakers walking on eggshells, the families fractured in ways the recoverers would not understand. He could keep them from shrinking back into the shadows, coax them into the light.

Lucy had greased the skids with Doctor Dale and Essex Geriatric, but their approval was genuine. They could see the new traumas that would come with the healing of the old, and wanted them assuaged as much as anyone. They already had Princeton University Press lined up to publish the volume, on generous terms for the authors.

So Joe could answer their questions effervescently, performing quite well, he thought. And why not? Today was as much a new start for him as for them. Before he knew it, he found himself echoing the announcer at those last games he had finally gotten around to seeing.

"Do you believe in miracles? *Yes!*"

Dozens of staring eyes, from family and strangers, fell on him. "Never mind, you kids," he said, his ebullience undiminished. "It's before your time." ■

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Terraforming Earth, Jack Williamson, TOR, $24.95, 349 pp. (ISBN: 0-312-87200-3).

The Treasury of the Fantastic: Romanticism to Early Twentieth Century Literature, David Sandner and Jacob Weisman, eds., Frog, Ltd. (P. O. Box 12327, Berkeley, CA 94712, 510-559-8272), $27.50, 747 + xii pp. (ISBN: 1-58394-030-8).

The Prentice Hall Anthology of Science Fiction and Fantasy, Gary G. Roberts, ed., Prentice Hall, $47 (at Amazon.com), 1166 + xviii pp. (ISBN: 0-13-021280-6).

Immodest Proposals: The Complete Science Fiction of William Tenn, Vol. 1, James A. Mann and Mary C. Tabasko, eds., NESFA Press (Box 809, Framingham, MA 01701), $29 + $3 s&h in US, $5 s&h international, 620 + vii pp. (ISBN: 1-886778-19-1).

From These Ashes: The Complete Short SF of Fredric Brown, Ben Yalow, ed., NESFA Press (Box 809, Framingham, MA 01701), $29 + $3 s&h in US, $5 s&h international, 693 pp. (ISBN: 1-886778-18-3).

Quartet: Four Tales from the Crossroads by George R. R. Martin, Christine Carpenito, ed., NESFA Press (Box 809, Framingham, MA 01701), $25 (trade), $35 (slipcased), + $3 s&h in US, $5 s&h international, 620 + vii pp. (ISBN: 1-886778-31-0).

What If Our World Is Their Heaven? The Final Conversations of Philip K. Dick, Gwen Lee and Doris Elaine Sauter, eds., Overlook Press, $26.95, 206 pp. (ISBN: 1-58567-009-X).

Is there life on Mars? This question has been of consuming interest for over a century, prompting speculation by astronomers, biologists, and science fiction writers and stimulating attempts to find it on the surface of Mars itself (the Viking landers) and in the interiors of meteorites which we judge from their chemistry to have come originally from Mars (expelled by major impacts). Findings have been intriguing but at best ambiguous, while the realization that microbial life reaches deep into the crust of the Earth and may there out- mass all the creatures of the surface has prompted thoughts of microbes evolved on the surface of a warmer, wetter Mars still persisting in

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the depths.

If Martian life indeed exists deep beneath the surface, we will have to drill to find it. And that's the back-story for Paul McAuley's **The Secret of Life**. The time is just twenty-five years from now. Science—especially biotechnology—has continued to become both commercialized and feared. Thus when the Chinese bring back a sample of Martian organisms extracted from the rock deep beneath the polar ice cap, certain businesses and governments are very interested. An agent arranges to obtain a sample of the "Chi" and pass it to a US government courier. Unfortunately, sabotage brings down the courier's scramjet flight, and the Chi is released into the Pacific Ocean.

McAuley doesn't reveal the consequences immediately, but they are essential to the plot: Something starts to grow, spreading across the sea's surface, incorporating the genes of local algae, adapting, thriving, destroying the ecosystem. The world is endangered, government is panicking, and the security lid is tight. And here's Cytex, very interested in the alien genes, eager to study, patent, and monopolize an entire planet's biology.

Enter Mariella Anders. Shortly after the turn of the century, she played a central role in finding and defeating the "Moses" virus that was causing live male births to plummet. Lately she has been working in the Arizona desert, advising Greens on self-sufficiency. Now she is being invited to go to Mars to learn just what the Chinese found, get a handle on it, and perhaps learn how to defeat this new crisis, too. Unfortunately, Cytex is funding the expedition and the scientific leader, Penn Brown, is an old foe.

Megapolitics and micropolitics, lusts for money, power, and position—these are the obstacles Mariella must confront as she pursues her own agenda: Hers is the classic view of science as a public activity, generating knowledge to be freely shared for the good of all humanity. Unfortunately, powerful forces are arrayed against her. When she returns to Earth, she must arrange to escape into the hands of subversives and radical Greens in order to manage her victory.

McAuley is here both thoughtful and eloquent. The commercialization of science and technology is no problem to the forces of commerce and government who see dollar signs everywhere they look, but it *is* a problem to scientists who respect the selflessness, sharing, and public service inherent in the nature of science. This is not to say that scientists cannot make mistakes, but the openness of science means that when mistakes happen, many more minds can be brought to bear to find solutions. Openness and sharing played a crucial part when Mariella led the charge against the Moses virus. The openness of her mind and her approach to problem-solving are at the heart of the enmity between her and the more closed-minded Penn Brown. And McAuley's drama brings it all nicely to life, with a nicely rounded protagonist to hold your interest.

Recommended.

In *Silverhair* (reviewed here in the July-August 2000 column), Stephen Baxter gave us a remnant population of mammoths, lingering in the world long enough to meet space-age humans and—he promised!—to get transplanted to a terraformed Mars. His mammoths talked and thought, had a history and a mythology, which were enough to see the book compared to *Watership Down* and its rabbits. And one of the ancient heroes, who led the mammoths to safety when humans first invaded their realm, was named Longtusk.

Longtusk offers the truth behind the myth (along with a few hints that the trip to Mars *will* be explained in due time). Some sixteen thousand years ago, the Siberian ice is retreating. The cli-

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mate is warming, and conditions are becoming less friendly for mammoths. Longtusk is but a youngster when a steppe fire drives him away from his family. A Neanderthal boy, Willow, saves him from a sabertooth, and provides shelter until he rescues a slim girl of a different sort and her clan attacks. These are the Fireheads (their shaman wears a bone headdress that holds a smoky fire)—tool-users, mastodon-tamers, artists, and lovers of death. Longtusk is enslaved for many years before he finally breaks free with Willow, discovers the remnants of his family in dire straits, and leads them to safety.

In the way of myths, the facts are both different from and more complex than what is told to the youngsters by their elders. But Longtusk is as admirable a hero as anyone could ask and his eventual death as noble as Samson's.

But I wish Baxter would stop teasing and tell us about mammoths on Mars!

Laurence M. Janifer is a familiar name in these pages, sometimes for his favorite hero, one Gerald Knave: Survivor (as it says on his business cards). The man is a freelance interstellar trouble-shooter loaded with attitude, and clearly a descendant of both Simon Templar and Sherlock Holmes, though he gets more interesting cases.

The latest case in point is **The Counterfeit Heinlein**, set on the scholarly world of Ravenal, where a librarian named Ping Boom has called him in. A rare manuscript has gone missing. Found in the ruins of a survivalist's ancient burrow on Earth, it purports to be *The Stone Pillow* by Robert A. Heinlein, and it is known to be an almost perfect forgery (antique paper and ink, and the isotope distributions are *almost* right). And someone is taking potshots at Knave.

Clues? The library's grounds have an awfully good security system, and there are no signs of how anyone got in, though there are marks on the display case. There is a secret society of SF readers (secret because SF is *still* not truly respectable), which includes several of the archeologists who were on the dig that supposedly found the manuscript. A bit of research finds that a few years back, someone was taking potshots at the Berigot—sail-planing, information-collecting aliens who make great librarians. Now a scholar is dead, apparently by the same gun.

Fortunately, Knave has two great assets. Master Higsbee is his hyper-brainy Mycroft. Robbin Tress is a wild talent who just knows things, though one must ask first; she's always right, too. Between them, they keep Knave on track while Janifer slowly unveils the machinations behind the baffling crime.

I always enjoy Janifer's tales of Gerald Knave: Survivor. So must anyone who remembers Sherlock and the Saint and perhaps wishes that they had had a chance to tread the larger stage of science fiction. (Well, the Saint had a few small opportunities, but he never did get off the planet.)

Have fun!

In 1999 and 2000, Batman's Gotham City underwent a terrible transformation. An earthquake shattered buildings and people, the federal government abandoned its responsibility to help, declared it officially No Man's Land, invited those who wished to flee, blew the bridges and the tunnels, mined the river, laid down a wall of razor-wire, and left the ruins to the Joker, Two-Face, Penguin, and the rest of the mad crew that had for so long kept the Bat leaping from rooftop to rooftop. Unfortunately, not everyone left. Many called Gotham home no matter what. Commissioner Gordon and a stalwart few remnants of the GCPD have vowed to continue to protect the good, even if they must become a Blue Boys gang to do so.

The asylum has let out for lunch, and the battles rage.

And Batman is nowhere in sight—but

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he hasn't forgotten his home. He's busy, and in due time he appears, the Dark Knight brooding over the ruins, calling Nightwing and Robin to his side, doing battle, and finally realizing what monstrous act of greed is being prepared.

Greg Rucka's **Batman: No Man's Land** is the novelization of the DC Comics story. If you like hyperbolic adventure, you'll enjoy it. If you're a Batman fan, you'll love it.

And if you prefer more ambitious fare, you'll pass.

J. D. Austin's **Bobby's Girl** is a lot of fun. On the distant planet Thradon, the nation of Dalyi—a bastion of freedom and prosperity quite deliberately reminiscent of the USA—is in trouble. In the past, it was a colonialist exploiter. Wising up, it put that behind it and turned to lifting up the Ebereans it had long put down. But the Ebereans were grudge-holders without peer, and in due time they struck. Dalyi's forces are shattered. Its government is fallen, and its leaders are about to be slaughtered—unless they can flee into hiding. Fortunately, they have a spaceship ready for their supreme general, Ket Mhulhar, just as soon as she can be remade into a human. Destination: Earth, and with luck the Resistance left behind will succeed and her fellows will be back for her. No luck, and it will be the foe, come to hunt her down.

Earth is quite unsuspecting. Ket is gorgeous, intelligent, and supremely competent. She staggers out of the desert into the arms of a retired couple who just happen to have an indie film producer as a son, and when Bobby shows up, it is no time at all before Ket—now Kate—is his script girl.

Thradon doesn't have movies. Hollywood is new to Kate, and she loves it. In fact, she dreams of going home with a brand new industry. But first she must fall for Bobby, he must fall for her, they must prepare for the eventual arrival of the Bad Guys, *and* they must turn the Fall of Dalyi into a movie.

Meanwhile, back on Thradon, the Resistance is taking effect. The oppressed citizenry of Dalyi is getting pissed off. The Eberean occupiers are beginning to realize that they can't hold what they have won, but they've found another spaceship and they figure if they can just get their hands on General Ket Mhulhar. . . .

Austin has a deft hand with plot and character and is plainly having fun with the story. You will too.

Jack Williamson was born in 1908, began publishing SF in 1928, was responsible for a number of very seminal works (*Seetee Shock*, *Darker than You Think*, *The Humanoids*. . . .), coined the terms "genetic engineering" and "terraforming," pioneered the university teaching of SF, and is still at it.

Nor is he doddering, as you saw last December when "The Ultimate Earth" appeared in this magazine. That story involved the recovery of a destroyed lunar base in the very distant future. The base had been established as a kind of insurance policy; if Earth were ever destroyed, its computer and robots would clone and train a crew to restore life and humanity. By the time of "Ultimate," humanity had spread well into the galaxy. The base—even if it had not been destroyed by a lunar impact—would have been a quaint anachronism. Its restoration, right down to a clone crew, was in the nature of an exercise in historical vanity.

But what happened in the long ages before the base was destroyed? Read all about it in **Terraforming Earth**, which starts after the surprise impact that turned Earth's surface into lava and rubble and forced the base into action before it was quite ready. The clones—Dunk and Dian, Tanya and Arne and Pepe, Casey and Mona—were raised by holographic versions of their originals, they learned the tales of their originals' careers and flight into space, and they

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preserved even the less charming aspects of their originals' personalities. In due time they succeeded in their mission. But then Earth was sterilized again, alien ecologies colonized and took root, human settlements sprang from the clones and their ova banks, and the hammer fell again.

Williamson seems to see humanity as doomed but resilient, destined to fall and rise and fall and rise, until. . . . The final vision is a sfnal take on a traditional glory, but I dare say no more for fear that you will not read the tale for yourself.

The Treasury of the Fantastic: Romanticism to Early Twentieth Century Literature is a massive compilation of "the widest variety of fantastic literature to ever appear in one volume, bringing together poetry and prose, children's literature and literature intended for adults, mainstream and genre writers, the Gothic and the fairy and the ghost story, the supernatural and the wonder tale, dragons, devils, revenants, vampires and just plain oddities," in the words of the editors. Everything is pre-1923 and hence classic enough for most definitions. You'll find Coleridge and Byron here, Irving and Hawthorne, Carroll and Wilde, Bierce and Wells, Kipling and Twain, Beerbohm and Woolf, and a nice foreword by Peter S. Beagle.

That's not much of a review, but the names mentioned are familiar to all. Perhaps some do not come to mind when one thinks of the fantastic—they are too "legitimate"—but they all contributed and their presence here attests to their role in creating a popular modern genre.

This is one for every family with kids, every town and school library, and every lover of grand stories.

The Prentice Hall Anthology of Science Fiction and Fantasy is designed more for the educational market. In his foreword, Jack Williamson says it "may be the best one-volume library of science fiction that I have seen." It contains work by many of the authors in the *Treasury* as well as many more (e.g., Leiber, Dick, Farmer, Norton, Spider Robinson, etc.). Coverage includes SF and extends into the 1990s. It adds contextual headnotes, a historical essay by Sam Moskowitz, and lists of film, TV, radio, comics, and other related materials.

In short, exhaustive and ample and again very suitable for families and libraries, as well as classrooms.

William Tenn (Philip Klass) is an extraordinary writer who flourished from the mid-1940s through the 1960s and remains—in the words of introducer Connie Willis—one of the "treasures of the field." His work was insightful, mordant, clever, witty, and very much among the best of what hooked a generation or two into reading SF. I can't help but envy the students who enjoyed him as a professor of English at the University of Pennsylvania.

As is its habit, the New England Science Fiction Association is celebrating this luminous career. You too can share the treasures to be found in such tales as "Venus and the Seven Sexes," "On Venus, Have We Got a Rabbi," "The Masculinist Revolt," and "Down Among the Dead Men." **Immodest Proposals: The Complete Science Fiction of William Tenn**, Volume 1, has thirty more. Volume II will include the novel *Of Men and Monsters*.

Another treasure from the same era was Fredric Brown, who died in 1972. Ben Yalow calls him an iconoclast and a prophet of absurdity and says he "is generally regarded as the best short-short story writer in the history of science fiction," with some of his work so embedded in the subconscious of the field that no one remembers who wrote the original tale. His novels included

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What Mad Universe and *Martians Go Home*, and he was just as well known in the mystery field.

You can now find his short work—111 stories (short-shorts, remember)—in **From These Ashes: The Complete Short SF of Fredric Brown**. Buy and be happy; you can't help but find enough to love to more than justify the price.

George R. R. Martin was the Guest of Honor at the 2001 Boskone, and I was very happy to say hello, for I hadn't seen him since I left Chicago in the mid-70s. His remark was, "We both had darker hair then!" And so we did.

In the interim he has become very well known as both novelist and screenwriter for reasons nicely displayed in **Quartet: Four Tales from the Crossroads**. Here you will find a chunk of a novel not yet finished, *Black and White and Red All Over*, concerning yellow journalists in pursuit of a New York Jack the Ripper in the 1890s. Here are "The Skin Trade," which won a World Fantasy Award, and "The Blood of the Dragon," a novella plucked from *A Game of Thrones*, the first volume of Martin's half-completed hexology, *A Song of Fire and Ice*. And here is "StarPort," a teleplay for a TV pilot, to show off the sort of work he has done for *Twilight Zone* and *Beauty and the Beast* and a great deal more.

Enjoy!

As Tim Powers notes in his foreword to **What If Our World Is Their Heaven? The Final Conversations of Philip K. Dick**, Philip K. Dick's image of "crazed, mystical, hermit-genius" is wrong. Novels such as *Valis* (reviewed here in April 1981) helped the image along, but Powers insists that the truth was more complex than simple irrationality. Dick went in for "gonzo-theology," yes, but he always maintained a sense of the absurd and of the implausibility of his own theories and he remained both self-derisory and realistic.

Not long before his death in 1983, Gwen Lee sat down with Dick and taped several rambling discourses on his reactions to *Blade Runner* (then in the works), his mystical experiences, and the only version of his planned novel, *The Owl in Daylight*, that the world will ever see. That last, of course, makes this book a must for Dick fans. □

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BRASS TACKS

Dear Dr. Schmidt,

Is it a case of practical time travel, or just ESP? Michael F. Flynn's (or has he changed his name to Pinero?) June 1994, article entitled "Pson Of Psychohistory" has proven amazingly accurate in forecasting the current state of our economy. Mr. Flynn unerringly predicted the 1995 downturn in the stock market, the peak in the late '90s, and then the slowdown in mid-2000 and the beginnings of the 2001 recession that now seems so obvious (sorry, Mr. Bush, but the seeming inevitability of those DD business cycles makes your proposed tax cuts to ostensibly "jump start" the economy appear to be fruitless from the start). Economists and analysts failed to predict the current situation, but a nearly seven-year-old SF article was most uncanny in its accuracy. If that accuracy continues to hold true, we're in for a five-year span "at rock bottom". And, as Mr. Flynn wrote, "Remember, you heard it here first."

Brian Pearson

The author replies. . . .

Well, the timings were a bit off and the '90s were rather better than the cycles would have indicated. It may be that the 50+ year cycle has started up already instead of waiting for 2006. Plus the political spin-offs were not what I supposed, largely I think due to the exact timing and individual personalities. Holding presidents responsible for such things (whether "Bush's" recession or "Clinton's" boom) is an old Northern European custom. When the harvest went bad you put the king in a wicker basket and set it on fire. What the government can do, I think, is adjust the amplitudes; but keep in mind that it is easier to make things worse than to make things better. (Cf. interest rate adjustments following the 1929 stock crash.)

Michael F. Flynn

Dear Stan,

I am thrilled that Robert A. Swenson enjoyed my story, "Graveyard Shift," (October 2000) and that he took the time to write a letter about it. (Brass Tacks, April 2001)

I'd like to respond to a comment in his letter. He voiced concerns that the refractometer I mentioned in the story was the wrong instrument to use when measuring the specific gravity of urine. He said, "Refractive index is not a measure of density or specific gravity. Refractive index can be used to measure dissolved solids in water."

Mr. Swenson has given me a great opportunity to elaborate on the clinical/medical application of the refractometer. It should be one of the first instruments a student in the field learns to use as it is one of the simplest, yet most elegant of devices. To quote the American Optical Company's Instructional guide (copyright 1961), "The TS Meter (TS = Total Solids) is a Goldberg refractometer which has been designed specifically for use in the medical and paramedical fields. Although the actual measurement is refractive index, the scales of the Model 10400 instrument have been calibrated in terms of total

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solids % composition for plasma or serum (grams/100 grams) and in terms of specific gravity for urine."

The guide goes on to explain that the device is temperature compensated for a temperature range of 60 - 100 degrees F. It needs no adjustment for differences in room and/or fluid temperature. Add this to the fact that the refractometer only requires a drop of fluid, and it becomes priceless for use in the clinical setting when the volume of urine from an infant, for instance, is often less than five milliliters, or as in the case of my story, the sample comes from an autopsy and there's no hope of getting any more.

A hydrometer, which Mr. Swenson suggests as an alternative for determining specific gravity, requires far more volume of fluid than is often available and also involves more handling and greater chances of contaminating both the specimen and the work environment. Neither is optimal when dealing with potentially biohazardous specimens. On the other hand, the hydrometer works wonderfully for beer brewing.

Kathy Oltion

Dear *Analog*,

I just finished reading "Talking Monkeys" in the April 2001 issue of *Analog*. I enjoyed the *Analog* story more than usual due to the fact that the author Rob Chilson had a future version of the World Wide Web called "Planetweb" on a planet being prepared for colonization. Planetweb was accessed through software in a "Pocket Brain," a future direct brain linked version of our common PDAs. I currently work for Planetweb, Inc. located in Redwood Shores, California. Planetweb makes small, embedded internet browsers and mining-server technology that allow access to the WWW, and its data, through consumer electronic appliances such as DVDs, TVs, game consoles, web phones and pads, web terminals, and home satellite and cable systems. Of course, our browser is called "Planetweb."

One of the things I enjoy about science fiction is the constant feed of science and technology to story writers and back again. It always puts a smile on my face when I see a story become, or parallel, reality or visa versa. In this case, I had a bigger smile than normal. Thank Rob Chilson for me.

Rob Gilbert

To the Editor:

My recollection from reading *The Time Machine* many years ago is that Weena was killed and eaten by the Morlocks, and her remains were discovered in their tunnels by the Time Traveller.

Reading "What Weena Knew" (April, 2001), it's obvious to me that Mr. Van Pelt used the movie version as reference material for his story, and not the original book. While the movie has a happier outcome, it is not completely faithful to Wells' novel, particularly in regard to Weena's fate.

To say that "What Weena Knew" is "a part of the story that H.G. Wells never knew . . ." is certainly correct, since the story is based on material written after his death.

Ernie Mercer

The author replies. . . .

Dear Mr. Mercer,

Thanks for commenting on "What Weena Knew," but I'm afraid the years since you visited the novel last have clouded your memory of *The Time Machine*. In the book, the Time Traveller (to stick with the British spelling) lost Weena in the woods the night the Morlocks attacked. He said, "I searched again for traces of Weena, but there were none. It was plain they had left her poor little body in the forest." But he never saw her body. When he reached the chamber where the Morlocks had held his machine, it was open, an obvious trap. He escaped after

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a struggle without seeing anything in the chamber.

I was always a bit bothered by his under-reaction to Weena's loss. That and his dismissal of the Eloi as simple children is what provoked me to write this story that fits into the cracks Wells left for it in his brilliant novel.

Although it didn't impact the writing of my tale, I'm well aware of the movie, which is interesting in its own terms, and I discuss them at the Webs of Wonder award-winning web site I designed for high-school educators interested in teaching *The Time Machine* at *http://www.sff.net/people/james.van.pelt/wells/teachwells.htm.*

James Van Pelt

Dear *Analog*,

I've enjoyed the magazine for thirty years, but this is my first nit letter. In the April 2001 issue, Mr. Van Pelt's "What Weena Knew" was quite enjoyable until I got to the part on page 62 where dinosaur bones crumbled at a touch in the museum. C'mon, 65 million-year-old dinosaur bones are rocks. Another few tens of thousands of years isn't going to make those rocks crumble at a touch. It was probably a display of an elephant or mastodon, right? How'd the editor let that one get by?

Denis Bergquist

The author replies. . . .

Thanks for your note about "What Weena Knew." I tried matching the actions of *The Time Machine* as closely in the story as possible. When Weena and the Time Traveller reach the museum in the novel, the Time Traveller comments on the "inevitable process of decay" that had effected the displays. As you point out, if what he touched were true fossils, they would not crumble. They were either very old bones or, as some museums use, casts of fossils. Wells' 1890's scientists calls them dinosaur bones in the novel as he does in the story. You are right. The character was mistaken.

James Van Pelt

Dear Dr. Schmidt,

Jeffery Kooistra's attack on premonition skeptics in his April "The Alternate View" column was way off base. Just the fact that he feels the need to try to turn the term "observer effect" into a weapon, rather than refute the observer-effect hypothesis, marks his argument as pseudoscience.

One of the main reasons for skepticism is the fact that no one who claims to have had a premonition has ever actually predicted the future. We never hear about these "premonitions" *before* the event that is supposedly predicted—it's always a case of someone saying, *after* the fact, "I had a dream about that last night/week/whatever." Predicting the past is easy, but it does not impress.

The fact is that with six billion people dreaming several times a night, 365 nights a year, there are bound to be a few coincidental match-ups between dreams and events. Without some way to say which dream is supposed to be a premonition, *before* the "predicted" events occur, the premonition hypothesis cannot be tested. One is reduced to either regarding all dreams as potential premonitions, with an accuracy rate of probably one in a billion, or accepting that "premonitions" announced after the "predicted" events have taken place are merely predicting the past.

Lee Helms

The author replies. . . .

Thanks for letting me see the letter from Lee Helms. Both in tone and in content his letter so perfectly embodies the caricature of the stimulus-response skeptic I discussed that it leads me to wonder if Lee isn't just putting us on.

Assuming he's serious, let me correct his misconceptions. I am not against

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skepticism. Indeed, I'm far more skeptical than most, even refusing to take claims of the validity of relativity or the Standard Model for granted. However, it is exceptionally bad scientific thinking to assert as true "the fact that no one who claims to have had a premonition has ever actually predicted the future." This thinking is as bad as if I had asserted "the fact that everyone who claims to have had a premonition has actually predicted the future."

Lee also says, "We never hear about these 'premonitions' *before* the event that is supposedly predicted . . ." Well, I *have* heard about premonitions prior to the event; I was even a participant in several. Indeed, such has even happened under "test" conditions (but these things are the stuff of which future columns are made).

I hope Mr. Helms is not in person the sort of skeptic that comes through in his letter. Otherwise, the stridency, umbrage, and inattention to relevant nuance that he displays here will guarantee that none of his friends, relatives, or acquaintances will want to tell him about their personal experiences with premonitions (or any other paranormal experiences).

Jeffery D. Kooistra

Dear Editor,

Ben Bova's new novel, *The Precipice*, is a good yarn, but blows it on economics. Put all Earth industry in space?

It takes energy to put mass into even Low Earth Orbit (LEO)—lots of energy. Twice what it takes for a ballistic toss to the other side of the world, and far more than it takes to move the same mass on the surface, via train or ship. Deorbiting finished products requires additional energy. Improved rocket technology, permitting decreased orbiting and deorbiting costs, can be expected to also decrease surface transport costs; the fusion rocket described in the story could very likely be applied to aircraft, and maybe to ship and train propulsion. Thus, orbital manufacturing, using raw material from Earth, will never be competitive with on-the-ground manufacturing, except for things that can't be manufactured on the ground.

Likewise, the technology to manufacture cleanly in space could certainly be applied to manufacture cleanly on Earth.

Where orbital manufacturing wins is using raw material from the Moon, and maybe from the asteroids, for products to be used in space. What could be sent down from space cheaply is energy; beams of microwaves from orbital solar power collectors. What wins is orbital factories, using Lunar material and Terrestrial labor (possibly through waldos), to manufacture power sats to provide clean energy to operate ground factories, to supply the needs of ground dwellers.

Not enough synchronous orbital positions? Put belts of power sats in low orbit, automatically switching from receiver to receiver as they pass within range.

Governments blocking the use of power sats, to protect domestic oil and coal industries? The Darwinian law of "Adapt or Die" applies to governments and corporations as well as to individuals and species.

Incidentally, putting CO_2 back into the ground may not be the best use of such output from power plants. Greenhouses could be operated with atmospheres high in CO_2; the plants would love it, and the gas would help absorb solar heat. In short, sell it to the Russians, Canadians, Chileans, etc. Use plants to remove the carbon from the gas, turning it into valuable food, fiber, etc.

Sidney J. Jolly
San Diego, CA

The author replies. . . .

The scenario depicted in my novel *The Precipice* includes three major eco-

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nomic factors: (1) widespread devastation across much of Earth from the sudden climate changes of the greenhouse cliff; (2) lower Earth-to-orbit costs, thanks to fully reusable Clipperships; (3) lower costs of natural resources from the asteroids, thanks to the Duncan fusion drive. These factors, together with the powerful emotional impact of the greenhouse cliff, motivate substantial industrial development in Earth orbit and on the Moon. "Substantial" does not mean "total," but generally through history, industrial operations have moved as close to the sources of natural resources as practicable. When most resources come from space, most industry will move there, sooner or later.

Ben Bova

Dear Stan,

One of the most enjoyable things about receiving my monthly copy of *Analog* is opening it up to the editorial page. You always present such thought-provoking pros and cons about such a wide variety of ideas that I usually wind up reading the piece twice . . . just to make sure I understand everything you are saying.

The May 2001 editorial, "A Perfect Fit," made me do an "a-*hem*." My wife has been suffering from multiple sclerosis for over ten years now, and we continue to be apprehensive when trying a new restaurant or even going to a retail store we haven't been to before. "Are you wheelchair accessible?" I always ask on the phone. You'd be surprised at the number of people who *actually don't know* if their place of business can accommodate a wheelchair or electric scooter. Your comment is on the money when you say that "it makes good sense" to install ramps or elevators and I agree that they are "worth the relatively small extra expense."

Case in point: our family dentist has two steps up from the outside of his office into the waiting room. To a person who has difficulty walking, those two steps can look like mountains, and be just as difficult to climb. After years of gently chiding him for not making the office a bit more accessible, he investigated the possibility of a portable ramp. These types of ramps roll up when disassembled (taking up very little space), and no modifications to the building were necessary. He made the decision to purchase the ramp, and now when my wife has an appointment, she can use her electric scooter literally from our front door to the dentist's chair!

I wish more establishments would see it his way.

Ray E. Skrabut
Floral Park, NY ■

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UPCOMING EVENTS Anthony Lewis

1–4 November 2001
WORLD FANTASY CONVENTION 28 at Hotel Delta Centre-Ville, Montreal, Quebec. Guests of Honor—Fred Saberhagen, Joel Champetier; TM—Charles de Lint. Registration—Attending:$125/C$175 until 30 June 2001, Supporting: $30/C$45 until 15 October 2001 (latest information at press time). Info—2001 WFC, c/o Bruce Farr, Box 7191, Chandler, AZ 85246-7191, (602)395-1945; email—brucex.farr@intel.com; URL—www.worldfantasy.org /wfc01.html

9–11 November 2001
ORYCON 23 (Oregon SF conference) at Doubletree Hotel Portland Columbia River, Portland, OR. Guest of Honor—Melanie Rawn; Editor Guest of Honor—Laura Anne Gilman; Artist Guest of Honor—Real Musgrave. Registration—$40 until 15 October 2001, $50 thereafter. Info—OryCon 23, PO Box 5703, Portland, OR 97228-5703. (503)722-9900. email—david_schaber@hotmail.com; URL—www.orycon.org/orycon23.

16–18 November 2001
ARMADILLOCON 23 (Austin area SF conference) at Hilton North, Austin, TX. Guest of Honor—J. Gregory Keyes; Editor Guest of Honor—Toni Weisskopf; Artist Guest of Honor—John Jude Palencar. Info—ArmadilloCon, PO Box 27277, Austin, TX 78755. (512)477-6259 (day), (512)477-2294 (evening). Email—ArmadilloConTX@hotmail.com. URL—www.fact.org/dillo.

23–25 November 2001
LOSCON 28 (Los Angeles area SF conference) at Hilton Burbank Airport, Burbank, CA. Guest of Honor—Patricia C. Wrede; Artist Guest of Honor—Chris Butler; Fan Guest of Honor—Lynn Gold. Registration—$40 until 31 October 2001; $45 at the door. Info—Loscon 28, 11513 Burbank Blvd., North Hollywood, CA 91601. Email—chair@loscon.org. URL—www.loscon.org/loscon/28.

29 August–2 September 2002
CONJOSE (60th World Science Fiction Convention) at Convention Center, et al., San Jose, CA. Guests of Honor—Vernor Vinge, David A. Cherry, Bjo & John Trimble, TM—Tad Williams. Registration—$140 until 10 July 2001, more thereafter. [These are the latest rates posted on the Internet as of the time this column went to press.] This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Info—ConJose, Box 61363, Sunnyvale, CA 94088-1363. Email—info@conjose.org, URL—www.conjose.org

Convention runners: If your convention has a telephone, FAX, email, or web page URL, please let us know so that we can publish this information.

Convention attendees: When calling conventions for information, do not call collect and do not call too late in the evening. It is best to include a S.A.S.E. when requesting information; include an IRC if the convention is in a different country. ■

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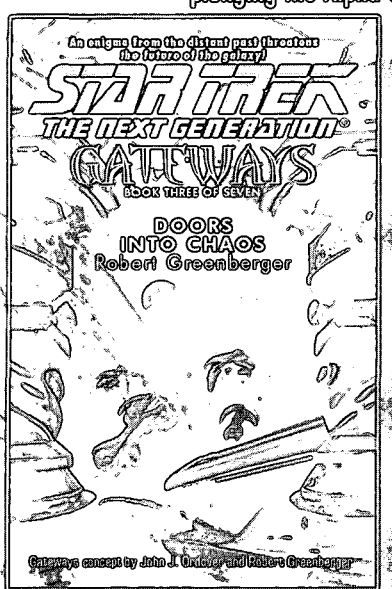
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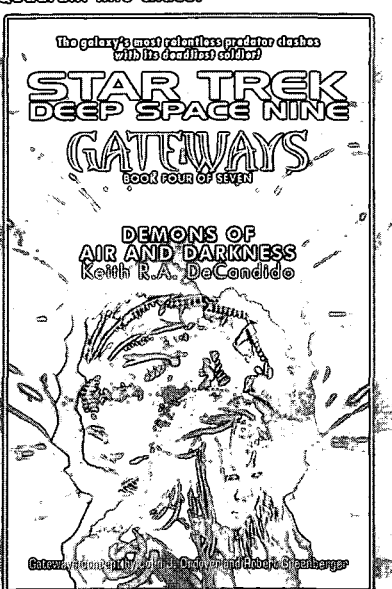
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put our Christmas presents away and keep 'em a while. They're too nice to use just at present. I sold the watch to get the money to buy your combs. And now suppose you put the chops on."

The magi, as you know, were wise men--wonderfully wise men--who brought gifts to the Babe in the manger. They invented the art of giving Christmas presents. Being wise, their gifts were no doubt wise ones, possibly bearing the privilege of exchange in case of duplication. And here I have lamely related to you the uneventful chronicle of two foolish children in a flat who most unwisely sacrificed for each other the greatest treasures of their house. But in a last word to the wise of these days let it be said that of all who give gifts these two were the wisest. O all who give and receive gifts, such as they are wisest. Everywhere they are wisest. They are the magi.

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